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COMMUNICATIONS

HETEROPHORIA*

BY
ERNEST E. MADDOX
BOURNEMOUTH

THE founder, and first master, of this Congress, Mr. Robert W. Doyne, was an exceptionally ardent benefactor of Ophthalmology. To him Oxford practically owes its Eye Infirmary, and the University its diploma in Ophthalmology.

The early meetings of the Congress are alive with memories to many of us of his genial presence, setting everyone at ease, even including, to our admiration, those unfortunate, if honoured, patients upon whom members of the Congress were allowed to operate.

On later occasions, the scene changed, and "pathos" entered. The well-knit frame, inured to manly sports, had been manifestly overworked (for he did the work of two men), and we saw the evening time of life gathering about him all too prematurely; illustrating how

> "Swift to its close ebbs out life's little day,
> Earth's joys grow dim, its glories pass away."

Among many other mementoes, he has left this Congress behind him, but not without first committing its welfare to the able hands in which it has continued to prosper.

We owe the name, and the classification, of heterophoria, which means a "tendency to differ," to George Stevens, of New York,

* The Doyne Memorial Lecture delivered at the Oxford Ophthalmological Congress, July 8, 1921.

whose English relations, it is interesting to note, were ancient benefactors of Wadham College, Oxford. For twenty years before his day, heterophoria was studied under other names, such as "insufficiency," and "latent deviations," under the presiding genius of von Graefe, and I notice in the literature that even what we now call hyperphoria was corrected by Mr. W. A. Brailey more than forty years ago.

Heterophoria is a tendency to imperfection in the oculomotor apparatus, so let us first glance at that apparatus itself. To begin with, there are several things it shares in common with the rest of nature, viz., *on* the surface diversity and beauty, and *under* the surface, unity, balance, habit and rhythm.

The diversity of nature is very evident, but the underlying unity is just as real. Gravitation, for instance, binds the whole universe in one, while radiant energy everywhere fills it with light and warmth. The same laws of motion which guide a schoolboy's marble, are implicitly obeyed by the remotest planet. This principle of diversity in unity is found in every *object* of nature, for the small reflects the great. It is strikingly so in living organisms, and is particularly well seen in the eyes. The cerebral hemispheres make the brain to look at, two, yet it is really one, and the eyes are windows (also two in one) through which that most deeply hidden of all the systems, the central nervous system, comes to the surface to look out upon the world. It is no wonder, therefore, that Hering long ago described them as a "single organ with two limbs." This single organ he called the 'Doppelauge,' and located it virtually behind the root of the nose. I have ventured to name it the 'Binoculus' as more easily pronounced. Pictures on the maculae are normally referred to the line which connects the binoculus with the point of intersection of the visual line. You may ask, if the eyes are virtually one, why there should be two? The duality of the eyes is necessary for *stereoscopic* vision, to give us two points of view meeting in one; for a *wider field*; for *safety* in the event of accident or foreign body; for *beauty* (for could you imagine yourselves proposing to a Cyclopean young lady? or to a lady with three eyes?), and lastly for silent *eloquence*; for eyes can speak. The poet expressed it in the well-known lines, "Soft eyes spake love to eyes which spake again." Together with the lids and eyebrows, the eyes express the passing emotions, as a silent lake reflects the changing sky. Just as the mind is linked with the cerebral cortex, so, it would seem, the emotions are linked with the vegetative nervous system, and the eyes are linked with both, for they express both thought and emotion. Their link with the vegetative system is well shewn by the gastric disturbance so invariably met with in acute glaucoma; and conversely, an ice-cream, as Lucien Howe mentions, will often cause a brow-ache. This "reverse action"

has a great bearing on heterophoria, for we may sometimes consider it the cause of symptoms when itself is caused by visceral irritation.

As regards the *muscles, nerves,* and *terminal* motor nuclei the eyes are two, but with respect to all higher neurons they are one.

It is a most important clinical distinction that all affections of the final common paths, are non-comitant, while all those of higher structures are comitant. Hence in the presence of comitancy we cannot use such expressions as weakness of the interni, of the superior recti, the obliques, or the like. It is not that such conditions are impossible, but if they are present, non-comitancy is present. If the internal recti were weak, there would be increase of the defect on looking to either side; if the superior recti, there would be hyperphoria on looking to one side, and the opposite hyperphoria on looking to the other side, and similar alternating hyperphoria as we might call it, would be in evidence if the superior or inferior obliques were weak.

Every intraorbital explanation of comitant deviations must be fallacious

The first great division of heterophoria, therefore, is into what I would call "Lower" and "Higher" heterophoria, according as it is non-comitant or comitant. It is clear that we need two different kinds of charts, one for the muscles (chart shown) and one for the reflexes (charts shown) and we need to be somewhat on the alert to know which chart is appropriate to a special case. I believe all reflexes act through the higher neurons. No single muscle is affected by a reflex.

Lower heterophoria, that is heterophoria due to one or more affected muscles, is, I think, very often overlooked, because we are so much in the habit of confining our photometry to the primary position where it may not show itself. The four diagonal areas of the motor field, are easily investigated by the disc of rods, the patient's head being placed in the required obliquity before a large tangent scale on the wall. If the disc is not held quite in a vertical plane, however, the red streak appears curved, which may vitiate the test. To guard against this I employ a disc (shown) swung as from a gallows, which hangs truly without being able to rotate about a vertical axis. I find this extremely suitable for measuring the torsion of the false image, and I have asked the makers of my tangent scale to let the board be fixed to the wall by a single screw at its centre of gravity, to allow of its rotation by an assistant, until parallel with the streak of light. A weak vertical prism before the other eye, or clipped on to the disc of rods, makes the test easier. I sometimes use a rotating wand attached to the wall, or to an old Bjerrum screen, by a nail through its centre. The diagnosis of paretic muscles is, of course, made on the same principles as for

frank paralysis. I still think that, for the vertically acting muscles, the best method is that outlined in my book on the "Ocular Muscles," namely to make the diagnosis from the vertical separation only, and then confirm it by the torsion; leaving the horizontal element out of account. (Demonstrated.)

CHART I.

OCULO-MOTOR REFLEXES.

KINGDOM 1 (or Home Office) (To create the binoculus.)		KINGDOM 2 (or Foreign Office). (To direct the binoculus.)	
HORIZONTAL—1. Convergence (Eyes Approximate)		7. Dextroversion (Both turn to the right)	
2. Divergence (Eyes Separate)		8. Laevoversion (Both turn to the left)	
VERTICAL—3. Right Hypervergence (R. rises and L. falls)		9. Surversion (Both rise)	
4. Left Hypervergence (L. rises and R. falls)		10. Deversion (Both sink)	
TORSIONAL—5. Incyclovergence (Both twist in)		11. Dextrocycloversion (Both twist to the right)	
6 Excyclovergence (Both twist out)		12. Laevocycloversion (Both twist to the left)	
a Function = Fusion	*e* Involuntary	*a* Function= Fixation	*e* Mostly voluntary
b Prevent Diplopia	*f* Motions contrary	*b* Powerless with Diplopia	*f* Motions parallel
c Unify the Eyes	*g* Stimulus = Desire for single vision	*c* Direct the gaze	*g* Stimulus = Desire for macular perception
d Take account of the 3rd dimension of space, and give consciousness of distance of objects	*h* More linked with vegetative system	*d* Take account of 1st and 2nd dimensions of space, and give consciousness of direction and attitude of objects	*h* Linked with labyrinths, and somatic equilibrating system
	i Meissner's Torsion		*i* False torsion

Let us now consider *higher heterophoria*. I would like to draw your attention to the twelve beautiful reflexes of which I believe six preserve the eyes in one, while the other six make them dance hither and thither. Some of them are familiar to you, others probably not. They are in six reciprocal pairs, on the "give and take" principle, and they no doubt have the "reciprocal innervation" discovered by Sherrington.

Hering took account of only five motions in framing his theory, and modern text-books of physiology enumerate no more, but in ophthalmology, others have gradually made themselves evident during the last thirty years, and I think now all these twelve are definitely proved, except the second, in favour of which two reasons

might be given, and two against. I have taken immense interest in trying to classify them into natural orders, as shewn in this chart.

Another list, I ought to say, has been made by Professor Savage, of Nashville, a list of ten, but differing from mine as being on the lines of lower heterophoria instead of higher, that is to say they are in terms of the muscles. The most interesting division I have found of the twelve reflexes is into two Kingdoms or groups, one of which might be called the "Home Office," since its function is to settle the domestic differences of the eyes; and the other the "Foreign Office" since all its interests are abroad. In the former the motions are all mutual, i.e., towards or away from each other; in the latter all parallel. These two groups never usurp each others functions, and yet work in perfect harmony. They are like a white man and a black man working harmoniously at two ends of one saw, and yet the white man always white, and the black always black. Indeed, what Hering found true of convergence and the lateral movements of the eye may be extended I think to the whole of each Kingdom.

The third dimension in space is the only one that interests the "Home Office," while the "Foreign Office" is exclusively concerned with the first and second dimensions. The "Home Office" effects fusion, the correction of diplopia, and the formation and preservation of the binoculus. It cannot direct the binoculus in the smallest degree. The "Foreign Office" alone can do that, and is concerned with fixation, orientation, equilibration and version. The "Home Office" acts under the stimuli of threatening diplopia of six different kinds. The "Foreign Office" is powerless to correct the smallest diplopia of any kind, and acts under the stimulus of volition from above, combined with a subordinate "fixation-reflex" from below. Miners' nystagmus is, I believe, largely due to a conflict between volition and the fixation-reflex, since the glitter on the coal solicits the latter while a blow is being voluntarily aimed at a non-glittering spot. This is only by the way. I think you will find the "Home Office" is more in touch with the vegetative nervous system and the "Foreign Office" with the somatic nervous system, and the labyrinths. This is a very interesting distinction if true, explaining why worms, indigestion, and teething, cause not parallel deviations, but squints, and I have definitely proved my own slight esophoria to be increased by gastric irritation.

These two Kingdoms may therefore be looked upon as two compound reflexes, playing a duet, as it were, upon the terminal nuclei of the twelve ocular muscles. They never strike single notes, but always *chords*. That is to say they never actuate single or even pairs of muscles. Now, I have no doubt, since the same chords have to be struck again and again, that linkages are formed between even the oculomotor nuclei of the 3rd, 4th, and 6th nerves,

to mechanicalise the work, just as linkages are opened up to the spinal cord for the fingers; for indeed the lower motor neurons of the ocular muscles are in series with those in the anterior horns of the spinal cord, just as the ciliary ganglion is in series with the prevertebral ganglia.

The first reflex (to take them now in detail) is an old friend, viz., that for *convergence*, the slackness of which causes exophoria, and its excess esophoria (I prefer the English pronunciation to the Greek ësophoria as distinguishing the sound better from exophoria). This Diagram (Fig. 1.) shows how the visual lines are approximated

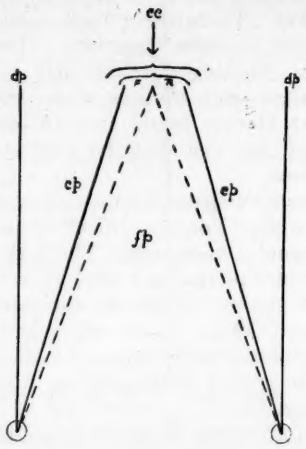

FIG. 1.—*dþ* distance posture. *cþ* convergence posture. *fþ* fusion posture. *cc* cerebral cortex impulses. *F R* fusion reflex.

towards the point of fixation by accommodative convergence, aided by postural habit. This is the coarse adjustment. The small bracket represents the fusion reflex which effects the fine adjustment. It not only makes the lines meet, but fastens them together.

You may wonder what is meant by the larger bracket. It represents a fusion-reflex augmented by voluntary effort. The arrow above it represents directed energy from above, perhaps from the angular gyrus, which Gordon Holmes has shown to be connected with visual attention.

However great the postural defect may be, if compensatory hypertrophy has made the fusion reflex large enough to overcome it easily, the heterophoria may be regarded rather as a harmless anomaly than as a pathological symptom. But the moment the work to be done is almost as great as the workman, the latter begins to labour, and trouble begins. The fusion reflex then

borrows energy from the centrons of neighbouring reflexes, and from the cerebral cortex, in the form of the "forced attention" referred to.

Now a reflex is a machine, that is to say, a labour-saving device, far more economical than voluntary effort. Sherrington has shown how especially untiring are the postural reflexes connected with the gravity muscles, and no doubt something similar could be said about those of the eyes, especially of the "Home Office." We have lately heard from him that the katabolic waste of voluntary motion is half a million times greater than of these postural reflexes. Whether that figure is correct or not, it at least makes us think. The cortex is the last part of the brain to mature, and the first to fail, and its exercise is the most tiring. The angular gyrus lies pretty far back, and the cerebellum has so much to do with these reflexes that the frequency of occipital headache in uncompensated heterophoria is not surprising, especially if the aolt-axoid muscles are also weary.

Since convergence is the strongest and most trainable of all the reflexes, its slackness (called exophoria) rarely needs treatment by prisms. Its link with accommodation enables us to influence it by spherical lenses, a treatment which next to constitutional measures, is the best. The correction of astigmatism also, and of hyperphoria, helps to preserve the converging reflex from diversion of its energy. For esophoria we use lenses which *fully* correct hypermetropia. For exophoria, generally those which *partially* correct it; but not always, for in neurasthenia a full correction may be best. "Exophoria with hypermetropia" has always been a great puzzle, but I think it due to a limited amount of nervous energy, of which so large a share is needed for accommodation as to leave too little for convergence. For many years I have treated exophoria in healthy young people by concave lenses, so as to invoke even superphysiological exercise of accommodation, and thus harness their abundant accommodative energy to the task of sensitising the converging reflex.

The *diverging* reflex (No. 2) is the only one I have not been able to prove positively. Exophoria from "divergence excess" is still only a theoretical conception. It is, moreover, almost impossible to distinguish between inhibitory neurons, acting on convergence, and a positive reflex acting on the external recti as its effectors. However, the analogy of the other reflexes disposes me to believe in the latter. Indeed, I suggested, thirty-five years ago, in the *Journal of Anat. and Phys.* that the external recti were innervated by the sympathetic in antagonism to convergence, just as the dilator pupillae antagonises the sphincter. In any case, there must be some mechanism, the proper stimulus of which is "threatening by homonymous diplopia," and which when damaged by haemorrhage causes sudden convergent strabismus, so I have ventured to include

it in my chart, with all deference to Sir George Berry's able arguments otherwise. Convergence may possibly be governed by vagotonic fibres if my thought of sympathetic control of divergence should prove correct.

I think all the reflexes of Kingdom I are (to borrow Sherrington's term) postural, and those of Kingdom II phasic. Certainly the vergences are less powerful than the versions. I have sometimes thought they are slower. The modern theory that the sarcoplasm

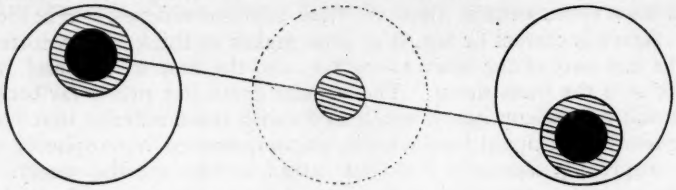

FIG. 2.

is controlled by the sympathetic, and the sarcostyles by the voluntary motor nervous system may, if true, have a bearing on these two main groups of oculomotor reflexes.

Nos. 3 and 4 are remarkable reflexes, which I believe to be of a *see-saw* nature. I have chosen the name survergence, not because it is the best, but to be in a series with hyperphoria. If a prism is held erect before one eye to test the prism-vergence, that one eye rises to overcome it, I believe, by one of these see-saw reflexes, in combination with the surverting reflex No. 9 which simultaneously raises both eyes equally, to preserve the naked eye from displacement. This arrangement looks so needlessly complicated, and it

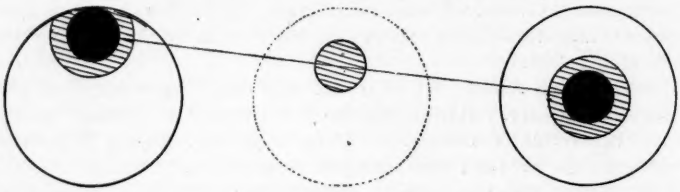

FIG. 3.

would be so much simpler for each eye to have the power of monocular adjustment (Prism-duction) that for many years I only mentioned these see-saw reflexes as probable in spite of the skew deviation of the eyes sometimes noticed when the middle peduncle of the cerebellum is damaged, until one day I had a remarkable patient who later went by the name of "Old See-Saw," for one eye rose as the other fell, in large regular, slow sequence. This settled

my last doubt. A little consideration will shew that such an arrangement must exist, if each of the two Kingdoms is to be true to itself. Thus Fig. 2 shews what would happen were right supervergence to take place by itself, while Fig. 3 illustrates the simultaneous surversion of both eyes, by reflex 9. In the first figure the "Binoculus" remains stationary; in the second it is raised half as much as the right eye, so that objects appear displaced upwards, through half the deviating angle of the prism, and this I have proved to be the case. It will be noticed that the see-saw motion itself alone leaves the Binoculus unmoved. It is most important that the mind should be sensible of every movement of the Binoculus, and since Kingdom I is incapable of conveying such sensation, it defers all movement of the Binoculus to Kingdom II. Herein we detect the reason for an arrangement which appears needlessly complicated. It enables each kind of reflex to mind its own business, and to supply correct information to head-quarters.

The normal function of the see-saw reflexes is to preserve the fixation lines in the visual plane. When we wear cylinders with oblique non-parallel axes, the see-saws are in constant alternating exercise as we look from side to side, since the prismatic effect of the lenses is such as to cause alternating hyperphoria. This is one of the chief reasons why oblique cylinders are so ill tolerated.

Since the hyperverging reflexes are of small amplitude, hyperphorics are nearly always grateful for correction by prisms. They are the least trainable of all the reflexes.

The *cycloverging* reflexes (5 and 6) act rather more on the obliques than on the recti, but so as to be thoroughly comitant in their effect which could not of course be possible were they to act on the obliques only. They not only correct cyclophoria but have, I suggest, an extremely interesting part to play in ordinary vision, for they enable the retinal images of sloping lines in the median plane to fall upon corresponding meridians. If I hold this penholder in the median plane, but with its upper end further from me than the lower, reflex 6 (excyclovergence) comes into play, otherwise I should see the pen double, with images crossing, while if the slope of the pen be reversed, so as to bring its upper end nearer to me, reflex 5 (incyclovergence) is active. It is well known that if two arrows are placed in a stereoscope diverging above, they appear to shoot away from the observer when fused; if diverging below, they appear to shoot towards him.

Cyclophoria in distant vision is easily measured by the glass rods as already described, or by cyclophorometers, and the result is sometimes valuable in helping us to decide which muscle to select for an operation. In my own eyes there is slight excyclophoria when fatigued, as by a long walk. In the year 1890 George Savage discovered the prevalence of excyclophoria in near vision while

experimenting with my double prism, and seven years later George Stevens published his first paper on declinations. More than sixty years ago, however, a torsion of the eyes in near vision was greatly studied by Meissner (1858), Volkmann, Helmholtz, and others, and later by Le Conte. It is called Meissner's torsion.

I will now invite you to make an experiment yourselves. Draw an upright arrow or line on the back of your programmes, and hold it closer to your eyes than the near point of convergence so that you see two arrows. In all probability they diverge above, shewing excyclotropia, since the images are crossed. If now you raise the paper so as to look under your eyebrows the mutual slant increases, but if you lower it so as to look down as far as possible, the arrows become parallel. This proves that in near vision there is a physiological excyclophoria, except on looking down, and that it gradually increases as the eyes are raised, and also, it may be added, as the object of fixation is brought nearer. We learn from this, what Helmholtz pointed out from Meissner's test, that in near vision the primary position of the eyes is one in which the visual plane is depressed, and indeed, we naturally cast our eyes downwards for near objects to let the hands and eyes work together.

If now you look at the same arrow with the eyes turned up to the right, you may notice one arrow rise higher than the other, while with the eyes turned up and to the left, the other arrow may rise. In my own case, the rising arrow indicates an alternating hyperphoria which points to comparative inaction of the superior recti as a partial cause of the cyclophoria, so that it may have both a "higher" and "lower" element.

(Before leaving the subject of cyclophoria, I might mention that in Professor Savage's list, the place of these cycloverging reflexes is taken by what he calls "harmonious symmetrical action of the obliques"; but I would suggest that harmonious action of the obliques is impossible. Any under or over action of the obliques would cause alternating hyperphoria, for on looking to the right or left the elevating power of the ipsolateral obliques lessens and that of the contralateral obliques increases. At the same time let us own that his theory aimed at the true thing; it only needs translating from lower, or incomitant, into higher, or comitant, heterophoria to be correct).

The first four reflexes of Kingdom II are too well-known to be dilated upon. I have ventured to shorten the awkward prefixes "sursum" and "deorsum" into "sur" and "de." These parallel motions are both voluntary and reflex. In their defects no diplopia can be elicited by the glass rod. There may be a limitation of version, *i.e.* of parallel movements of the eyes, in one direction, or there may be merely a preponderance of one reflex over its antagonist. I regard it as a phoria if there is no vicarious inclination

CHART II.

CONJUGATE OCULOMOTOR NOMENCLATURE.

KINGDOM I (or Home Office).				KINGDOM II (or Foreign Office).			
	MOTIONS.	PHORIAS.	TROPIAS.		MOTIONS	PHORIAS.	TROPIAS
1	Convergence	Esophoria	Esotropia	7	Dextroversion	Dextrophoria	Dextrotropia
2	Divergence	Exophoria	Exotropia	8	Laevoversion	Laevophoria	Laevotropia
3	R. Hypervergence	R. Hyperphoria	R. Hypertropia	9	Surversion	Anaphoria	Anatropia
4	L. Hypervergence	L. Hyperphoria	L. Hypertropia	10	Deversion	Katophoria	Katatropia
5	Incyclovergence	Incyclophoria	Incyclotropia	11	Dextrocycloversion	Dextrocyclophoria	Dextrocyclotropia
6	Excyclovergence	Excyclophoria	Excyclotropia	12	Laevocycloversion	Laevocyclophoria	Laevocyclotropia

Vergences are contrary motions of the eyes (mostly involuntary).
Versions are parallel motions of the eyes (mostly voluntary).

Prism-vergences are changes effected in the mutual posture of the eyes by prisms which are "overcome."
Ductions are drawings of a single eye in any direction of its muscles.

Torsion means twisting of an eye about its own fixation line=wheel motion.
Cyclovergence means mutual contrary wheel-motion of the two eyes; **cyclotropia** the result; and **cyclophoria** the tendency thereto.
Declination means angular departure of the vertical axis of one eye from parallelism with the median plane of the head.

Phorias are "tendencies," checked in Kingdom I. by the fusion reflex; and in Kingdom II. by the desire to keep the head straight.
Tropias are "turnings," causing in Kingdom I. squint; and in Kingdom II. inclinations of the head.

The prefixes **sur** and **de** are contractions for "sursum" and "deorsum" (compare surmount, deject, etc.)

of the head. If the head be turned to save the weak verting reflex, it is really no longer a case of phoria but of tropia. Stevens made a great study of anaphoria and kataphoria (but without making this distinction), and more recently Valk has written, well and ably, on dextrophoria and laevophoria, as studied by Stevens' tropometer. As so many become confused about nomenclature, I have drawn up this chart of the terms which I prefer.

The *cycloverting* reflexes (11 and 12) are, I am satisfied, well proved, and even their amplitude can be, to some extent, measured. They enable us to judge of the erectness of objects. When we look at a picture, for instance, to see if it is straight on the wall, we instinctively incline our heads slightly to one side and the other to put these reflexes on the *qui vive*.

It is only in this indirect way that they might be called voluntary. They are also involuntary steadiers of the eyes in its other parallel movements, but they do not, as some have supposed, either cause or nullify "false torsion" (Diagram) for that is already perfectly accounted for, as a simple mathematical necessity, by composition of the vertical and horizontal parallel movements of the eyes.

Lucien Howe, author of the most complete text-book of the Ocular Muscles, has suggested a number of other innervations for the oblique movements of the eyes, but, as I cannot discover these, I have not charted them.*

What first led me to pay attention to muscle balance, was the discovery, while experimenting with two pin holes in a piece of paper, that I had a slight esophoria for distance. To investigate this more fully, and at the same time find out how one eye would behave if placed in the dark, I constructed this dark box nearly forty years ago, and it was kindly shewn by Mr. Nettleship to the Ophthalmological Society. Its aim was to utilize the blind spot to record the movements of the eye. I found by its use that I had an exophoria of about one metre angle in near vision, and to my surprise a great many others had similar deviations of varying degree, so much so, that for a time I called it "physiological exophoria," a name which I have now abandoned, since it might make the numerous exceptions which occur, especially in young people, to be thought unphysiological. Von Graefe's test for near

*Professor Savage has published a theory that in the oblique movements of the eyes, the vertical axes of the eye-balls are preserved in parallelism with the median plane by "harmonious non-symmetrical action" of the Obliques; that is to say, the Right Superior Oblique working with the Left Inferior, and the left Superior with the Right Inferior. I regret my inability to endorse the views of so earnest a worker, for to begin with, the vertical axes of the eye-balls do become inclined to the median plane in the oblique movement of the eyes as a necessary consequence of Listing's law, just as the horizontal axes become inclined to the horizontal plane in the opposite sense, and secondly any such combined action of the pairs of obliques named would result in a vertical squint. For example, if the right superior oblique were to act with the left inferior oblique, the right eye would sink and the left rise.

vision, till then universally employed, consisted of a dot with a line through it, reduplicated by a prism, base down before one eye. It did not seem to occur to von Graefe that the overlapping of the portions of the line would suffice to maintain fusion, so that his test only revealed deviations in extreme cases, and led to the belief that the normal relation between convergence and accommodation was a fixed one. I must resist the temptation to describe a number of other experiments with this box, from which, indeed, I learned most of what little I know about oculo-motor physiology more than thirty-five years ago. A better way of using it is to disregard the blind spot and make the two points of light appear one over the other when the deviation can be read off direct. Its findings were confirmed at the same time by two other tests which occurred to me at the same time, the double-prism and the arrow tangent-scale, both of which were much used for some years until the first begat the rod-test, and the second the wing-test. Perhaps the prettiest appliance I have made is the twin-test, consisting of two celluloid sheets of complementary colours in apposition, and so pricked through that designs appear which can be brought to coincide. My "near vision phorometer" is also good if well made, but I have not brought it to-day, for neither method secures the accommodation quite so well as the wing-test. I find in practice that, on the principle of the survival of the fittest, I have gradually dropped all other tests except the rods for distance, and the wing for near, supplemented by the redress and the parallax tests (the latter so ably advocated by Duane), and my prism-verger occasionally. I think no refraction is complete without measuring both the distant and the near posture. The rod test you probably know already; I like it made with very thin rods, and not too small in area. It is best used in a room dark enough to avoid adventitious reflections, and yet with enough light to secure accommodation. I have in my own eyes esophoria of 1°, but if one eye be screened I have ½° only. I have found many to have both in far and near vision ½° less esophoria, or ½° more exophoria, on screening.

This is due to slackening of the converging reflex when one eye is completely covered. It is not so wide awake with one eye as with two. In the wing test both eyes receive a natural stimulus to accommodation. I have crowded the wings close to the eyes for horizontal measurements to avoid exciting the ciliary muscle, for objects which are hopelessly near do not tempt accommodation. It is important to make sure that the apparatus is correctly made, so that the object intended for each eye is entirely hidden from the other eye. I have provided the rotating wing test with a means of measuring cyclophoria, both by vertical and horizontal lines, using the distant pillar for the first, and the wings set nearer and cross-

wise for the second. You will generally find a difference between the two measurements, due at any rate in part to the curious fact investigated by Helmholtz and others, though denied by Savage, Stevens and Le Conte, that the physiological dividing line between the two lateral halves of the retina is not perpendicular to the horizontal meridian but slants down and in. I have investigated the point and I find the Helmholtz retina exists in most eyes, but not in all. (Here the audience was tested, and many noticed it.) The wing-test is of great service in the correction of presbyopia. If the arrow trespass ever so little on the esophoric side, we may safely increase our correction, while an unusual degree of exophoria will make us careful to keep it as weak as we can without loss, though of course other considerations come in as well. The most important minute of a refractive consultation is that in which we deliberate what reading lenses to order, for it is easier to make mistakes in near than in distant vision.

The wing-test can also save us sometimes from over-correction of hyperphoria. We may, for example, find 2° for distance and 1° in near vision. For hospital use, my rotating pattern is rather fragile, and I have for many months tried to puzzle out an instrument free from all movements, and therefore stronger. I have at last succeeded. One fixed chart now measures the horizontal, vertical, and torsional elements, all " in one go." After the horizontal balance has been measured, the arrow should be set at an angle that makes it appear horizontal to the patient. Then we can read off the hyperphoria and the cyclophoria.

The treatment of heterophoria becomes a simple matter as soon as we thoroughly understand its nature.

Each case needs taking on its own merits, so I need only touch on some elementary principles.

1. Discover the cause, and remove it if possible.

2. Correct any error of refraction, with perhaps a little decentering of the lenses in the direction of relief. At the same time treat the constitution with any necessary advice as to regimen, and the use of the eyes. If symptoms entirely disappear, no more need be done, even if the heterophoria remain. It will almost certainly grow less in time, for the tendency of every organism, is, I believe, to " come to itself " when untrammelled.

3. If lateral deviations are complicated by hyperphoria, correct the vertical deviation first and the lateral will very likely correct itself.

4. If, after the above treatment, some symptoms still continue, *train* the weak reflex, or the weak muscle as the case may be. Training is chiefly indicated in young people. It is only suitable for older ones when they are possessed of sufficient vigour. In neurotic or neurasthenic cases it should not be commenced until the

nervous system, both ocular and bodily, has been strengthened, and should be commenced during a holiday or bracing change. Undue recession of the convergence near point (or sub-convergence as I like to call it) can be trained by drawing an arrow on a piece of paper and approaching it to the eyes again and again while endeavouring to keep it single. Reber's lateral version exercises may help, somewhat, in the same way that rowing helps writers' cramp, by bringing fresh blood to the structures concerned without actual exercise of the weakened neurons. *Prism exercises* come next. I often give young people a second pair of spectacles resembling those they wear, but with adverse prisms incorporated, and bid them wear these training spectacles at certain favourable hours of the day. Whenever the prisms are more easily overcome in near than in distant vision they can begin by looking at a point on the wall close up to it, and then receding backwards to the other end of the room, repeating this again and again early in the morning, or after breakfast, or before the eyes are tired (Gould). When glasses are not worn, I order prisms set in circular rims, so that as the reflex is strengthened the base apex lines can be made to lie at greater and greater angles from each other by rotating the prisms in the frame. Lastly, the most powerful training of all is obtained by the simultaneous rotation of two prisms, as in my prism verger, the object being a disc of ivory or white paper in the centre of a Bjerrum screen. Training in the consulting room, however, is only practicable for those surgeons who are blest with sufficient leisure.

5. Operation. This generally is the last resort after we have helped nature to do her best. It is invaluable in some cases and especially when we can convert a non-comitant deviation into a comitant one (Duane). Hence, before operating, the whole field should be measured to find a weak muscle, the operation should be planned so as to correct simultaneously any cyclophoria, and in lateral deviations any hyperphoria. Lastly, the strength of the opposing reflex should be measured by prism-vergence, especially for a tenotomy. I say the opposing ***reflex*** because it is not enough for the opposing ***muscle*** to be strong. (For example, however strong the internal rectus may be, we shall obtain no effect from tenotomy of the external in the primary position if the converging reflex is inactive. The internal rectus may be strong for phasic motions, and yet the posture be weak). Exercise of the convergence, however, may often be trusted to bring about a sufficient augmentation of the reflex to make tenotomy advantageous. I have had excellent results from graduated tenotomy of an inferior rectus for old standing paralysis of the opposite superior oblique (restoring the head for example in the case of one medical friend to the erect position, after being tilted for years toward one shoulder). Even cyclophoria is sometimes worth operating for. I have recently seen

a patient on whom I operated for this more than twelve years ago. Previously to the operation he had headache without intermission for seven years, dating from typhoid, and he has had no headache since. But these operations are extremely tricky, and in higher heterophoria it is rather a responsibility to convert a comitant defect into a non-comitant one by operation. Here again, however, nature comes to the rescue and gradually restores more or less comitancy if a muscle is only tenderly dealt with by operation, on the principle of "reversion to organism," as we might call it.

The most successful surgeon is the one who understands nature best. You may perhaps wonder that I have said nothing about the evolution of the oculo-motor apparatus, but, Gentlemen, when I look at your intelligent faces, and the soul in your eyes, I cannot bring myself to believe that you are descended from maggots, and spiders, and pigs. The whole voice of nature, as I hear it, is against that fantastic theory. Nature is conservative and not progressive. She reverts to type as soon as the reason for departure from it disappears. When I see a piano, I do not at once jump to the conclusion that because the keys are in progressive series, therefore they must have evolved out of one another!

I thank you, Gentlemen, for your kind attention, and I have now the pleasure of laying this imperfect lecture as a little memorial wreath upon the tomb of our friend and benefactor, Robert Walter Doyne.

THE PATHOLOGICAL ANATOMY OF RETINAL DEGENERATION WITH MULTIPLE ANEURYSMS*

BY

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LEBER has already given a clear account of the clinical side of cases of retinal degeneration with multiple aneurysms with reference to some thirteen cases previously recorded[1, 2]. On the anatomical side we have, however, but little knowledge, the only published case being that recorded by Morton and Coats[3]; and this only came under examination several months after complete blindness had resulted.

We have lately had the opportunity of examining a comparatively recent case of this rare disease. The clinical history of the case was as follows:

T. O., a boy of 15, in a school in Japan, was first seen on

*Based upon a paper read by Dr. S. Miyashita before a meeting of the Japanese Ophthalmological Society, on April 3, 1919.

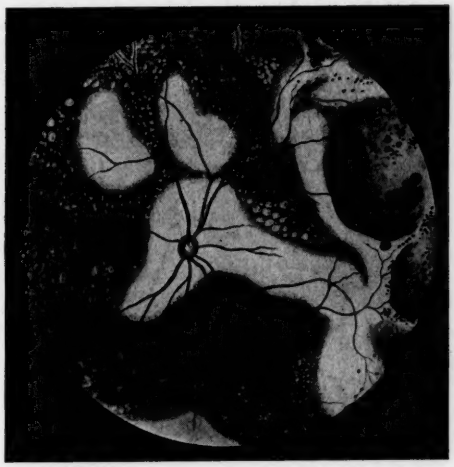

FIG. 1.—Fundus oculi of right eye as seen by the indirect method. Shows large tumour-like prominence and massive exudation.

FIG. 2.—Shows the tumour-like prominent part of retina containing a large number of enlarged and convoluted blood vessels.

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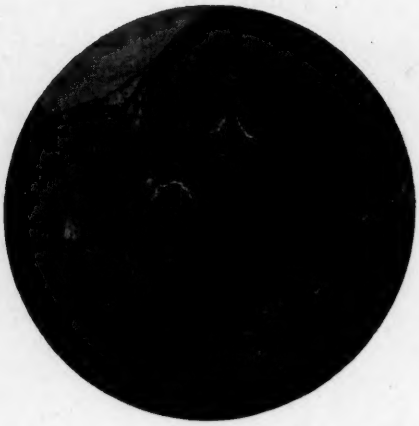

FIG. 3.—Shows the same structures as in fig. 2, but more highly magnified so as to show the fibrin in the outer layers of the retina and the granular fat cells in the subretinal exudation.

FIG. 4.—Shows the enlarged blood vessels and hyperplastic connective tissue.

January 7, 1918. Neither his family nor his personal history gave any evidence of constitutional disease. At the age of three he was found to be shortsighted. In April, 1917, the right eye failed and developed a central scotoma. Under treatment this improved, but relapsed in October of the same year.

On examination in January, 1918, the patient was found to be moderately nourished, with no signs of any constitutional disease. Wassermann reaction was negative, but v. Pirquet's reaction was slightly positive. Both eyes were myopic. R.E. vision, fingers at 2 metres, after correction, (−1.75 D.), 0.1. L.E. vision, 0.1., after correction, (−1.5 D), 0.9.

The left eye was, apart from the myopia, normal in every respect. The pupillary reaction of the right eye was sluggish and the fundus showed the following changes. Optic disc was hyperaemic and not sharply defined. The main central blood-vessels appeared normal, but the peripheral portion of the superior and inferior nasal and temporal vessels was dilated and convoluted. In the retinal periphery, particularly along the upper and lower temporal vessels, there were present a large number of small red globes like aneurysms, but none were to be found on the nasal side. The majority of these globes were round, but some were elliptical or irregular. The larger ones measured from one-third to one-half the diameter of the papilla, and two of them situated on the periphery of the superior temporal vein and several in the lower temporal periphery had a white spot in the centre. The majority were much smaller, at times set in a row, and at other places more or less scattered. One very conspicuous one, as large as the optic disc, was attached to the peripheral part of the superior temporal vein. Its centre looked gray. The vein seemed to pass through it. The red globes as a rule were mainly seen along the arteries.

In addition to the red globes, retinal exudation resembling the clouds in a summer sky was found in large white patches of a silvery brilliancy. Between the larger patches there were seen thousands of small brilliant white spots. None of the exudation obscured the retinal vessels which were to be seen passing over it, though in places the vessels were sheathed by white lines for a short distance. Near the termination of the inferior temporal vessels, where the red globes described above were most numerous, the retina was raised in the form of a tumour with a prominence of seven dioptres. This prominence was elliptical in shape, of pinkish colour with some haemorrhages on the surface. The visual field was contracted but the colour sense was normal.

The patient was admitted to the hospital on January 14, 1918, and on the following day was given a subcutaneous injection of 0.1 c.c. of 0.1 per cent. T.O. This was not followed by any reaction.

January 19. Intraocular tension R.E. 16 mm. Hg. (Schiötz), L.E. 20 mm. Hg. (Schiötz).

January 20. 0.2 c.c. of 0.1 per cent. T.O. administered. No general reaction, but some increase of the retinal exudation.

January 22. 0.2 c.c. of 0.1 per cent. T.O. No reaction.

January 26. 0.4 c.c. of 0.1 per cent. T.O. Increase of retinal exudation. Temperature rose to 38.3C. with shivering and headache.

February 2. The retinal exudation was still increasing and the tumour previously noted was larger. V. with —2D., fingers at 2.5 metres.

February 5. The right eye was removed and immediately fixed in Zenker. It was embedded in celloidin and cut in serial sections.

Pathological examination showed the following result. Cornea, iris, ciliary body, lens and optic nerve were normal.

Choroid.—All blood vessels extremely dilated and the intervascular tissue slightly loose, so that the choroid, as a whole, was thickened. In the connective tissue were numerous mononuclear cells containing eosinophile granules, and, in places, round cells formed a perivascular infiltration. Hyperaemia was marked, but no distinct signs of inflammation were noted.

Retina.—The subretinal exudation consisted mainly of coagulated albumen containing numerous mononuclear granular fat cells and, also, a few polynuclear leucocytes, some blood-vessels, and a little fibrin. The amount of exudation was variable but never entirely absent. Where the exudation was most marked the retina was pushed forwards towards the vitreous, the edges of the exudation being always occupied by the granular fat cells. Near the ora serrata on the temporal side the retina was conspicuously thickened into the form of a tumour-like prominence.

The retinal structure showed the five following types of alteration.

1. Oedema of the retina was limited to the prominent part noted above; here the loose connective tissue showed cavernous spaces.

2. Hyperplasia of connective tissue was also limited to the prominent part of the retina. The fibrous tissue was of recent formation and consisted of spindle-shaped cells crossing in all directions and containing dilated blood-vessels.

3. **Blood-Vessels.**—Chiefly in the inner layers of the retina, and associated with the hyperplastic connective tissue described above, there were present numerous closely set dilated blood-vessels. These appeared in section either round, elliptical or kidney shaped, and sometimes presented an appearance like that of a cavernous angioma. Thrombi were to be found in the larger vessels sometimes completely occluding them. Along the inner wall of the vessels polynuclear leucocytes were generally to be found. The vessel

walls were thin and showed hyaloid degeneration and infiltration with fibrin and mononuclear lymphocytes. These latter were sometimes found surrounding the vessels, sometimes also infiltrating the entire section of the vessels and in other places more localized. These changes were found in places even where the retina was not prominent. The lymphocytes were sometimes found associated with leucocytes containing eosinophile granules. The enlarged vessels contained no elastic fibres, but these were present in the unchanged vessels even close to the altered vessels.

Summary of vascular changes.—Aneurysmal enlargement and convolution of small vessels in retinal periphery, infiltration by lymphocytes, formation of fibrin, destruction of elastic fibres, and formation of thrombi. All the retinal capillaries in the neighbourhood of these changes were enlarged.

4. **Haemorrhages.**—These were found along or near the dilated vessels in both the inner and outer layers of the retina, spreading between the hyperplastic connective tissue fibres.

5. **Fibrin.**—The retina contained a large quantity of fibrin, which was to be found in smaller quantity far from the haemorrhages and reaching only to the internal nuclear layer. The granular fat cells mentioned above were usually to be found in the outer layers of the retina. In the prominent part of the retina polynuclear leucocytes were also to be found.

As a result of these pathological changes in the retina the rods and cones were destroyed by the invasion of fat cells and fibrin, especially in the prominent part. The internal nuclear layer was normal except for the presence of the aneurysmal vessels. There was some hypertrophy of the glia fibres.

On comparing the ophthalmoscopic appearances with the result of the microscopic examination we note the following points.

1. The prominence noted in the retina corresponded to the portion found thickened and pushed forwards by the exudation in the subretinal space.

2. The red globes found on ophthalmoscopic examination were made up of the enormously dilated vessels and of the haemorrhages into the perivascular lymph spaces together with the thrombi.

3. The large white exudation corresponded to the granular fat cells lying along the edge of the subretinal space.

4. The smaller white spots were probably due to small collections of fat cells in the layers of the retina.

5. The sheathing of certain blood-vessels was probably caused by the infiltration of the vessel walls with round cells and granular fat cells.

To sum up the pathological changes observed. These all took place in the lower temporal periphery of the retina near the ora serrata. They consisted in definite degeneration of the vascular

wall with dilatation and convolution of the vessels. This was followed by thrombosis in the interior of the vessels, hyperplasia of the connective tissue and haemorrhages in the inner and outer layers of the retina, destroying the membrana limitans externa. The extravasated blood, almost completely defibrinated, spread between the retina and choroid. The retinal changes were caused, in our opinion, by the fibro-angiomatosis. They were similar to those described by Coats and Morton[3]. Hata[4] reported this year a case of this disease from Tokyo University. The retinal changes observed by him only differed from those found in our case in the localisation of the new-formed connective tissue, this being found at the macula as well as the periphery. The choroid was more affected than in our case.

The amount of exudation in the subretinal space seems to indicate some inflammatory change, but we consider that this may really be entirely secondary to the degeneration of and thrombosis in the blood-vessels which would produce a violent disturbance of the circulation resulting in haemorrhage, and transudation and migration of granular fat cells, etc. Coats (l.c.) considered that the haemorrhage in the outer retinal layers was the primary change and was followed by hyperplasia of connective tissue fibres. We found no evidence of the organization of haemorrhage, but observed haemorrhage spreading between the hyperplastic connective tissue fibres. Moreover, the haemorrhage in our case was not confined to the outer layers, but also was found in the inner layers of the retina. Nor are we able to agree with Leber in considering embolism to be the cause of the aneurysmal formations. If we assume that the disease is of an inflammatory nature, tuberculosis appears to be the most likely origin, an hypothesis suggested by Leber. We have ourselves seen a case of retinitis undoubtedly tuberculous in origin, in which the appearances were very similar to those just described. It is noteworthy that the disease usually begins near the ora serrata, just where the blood stream is at its slowest. It was this fact that suggested to Leber the probability of embolism being of aetiological value.

We consider that the disease may be traced to a hereditary weakness of the blood-vessels. At a comparatively early age degeneration sets in in the smaller vessels, and, as a result, new and convoluted vessels of an inferior type of structure are formed. If the aneurysmal dilatations observed were due to some primary change, we should expect to find some evidence of destroyed elastic fibres; such evidence was completely absent.

We consider that the evidence points to the disease being of the nature of an angio-fibromatosis followed by a general degeneration of the retina. We are thus able to bring our case into close relationship with the disease known as v. Hippel's disease.

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DECENTRATION AND OBLIQUE CYLINDERS

BY

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WHEN prescribing spectacles it is frequently necessary to give a correction for a hyperexo- or a hypereso-phoria, and there are three ways of doing this.

The simplest, and the worst, way is to correct the hyperphoria in one eye with a vertical prism, and to correct the lateral defect in the other eye with a lateral prism. Suppose for instance that a patient needs a correction of $2\bigtriangledown$ for a right hyperphoria and a correction of $3{\cdot}5\bigtriangledown$ for an exophoria; he might be given a $2\bigtriangledown$ prism edge up before his right eye, and a $3{\cdot}5\bigtriangledown$ prism edge out before his left eye.

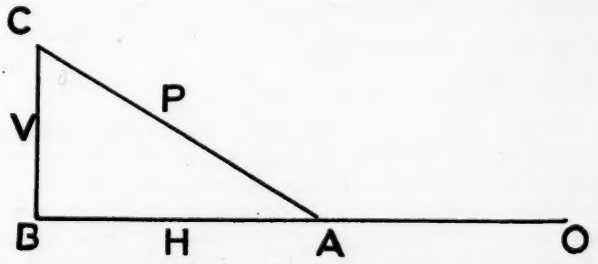

FIG. 1.

The second method is to divide the necessary correction between the two eyes. As is well known, prisms obey the parallelogram law, i.e., a prism set obliquely at an angle α with the horizontal may be resolved into two components:—(Fig. 1.)

V the vertical component, where $V = P \sin \alpha$.

H the horizontal component, where $H = P \cos \alpha$.

We are given V and H, and we have to find P and α. Of course $P = \sqrt{V^2 + H^2}$, and $\tan \alpha = \frac{V}{H}$

A simple and sufficiently accurate way of doing this is to draw AB horizontal representing in direction and units of length

(centimetres) the power and action of the horizontal component H, and from B to draw a perpendicular BC to similarly represent V; then AC is the vector representing in length and direction the power and the inclination of the equivalent prism P. In this case as a 1 ∇ vertical prism and a 1·75 ∇ lateral prism has to be provided for each eye, draw AB 1·75 cm. long (A representing the base of the prism) and erect the perpendicular BC 1 cm. in height (B representing the base of the vertical prism); join AC, then AC which is 2·0155 cm. long represents the required prism for the right eye with its edge pointing outwards and upwards at the angle α. One would order a 2 ∇ prism pointing outwards and upwards at the angle 30° for the right eye, and a similar prism for the left eye pointing outwards and downwards, 30°. The 2 ∇ correction for the hyperphoria would then be given, and 3·446 ∇ instead of 3·5 ∇ for the exophoria. It will be noticed that now the two prisms together only amount to 4 ∇, whereas according to the first method the sum of the two prisms is 5·5 ∇.

There is a third way of dealing with the problem if spherical or spherocylindrical lenses are to be worn, which is much easier for the optician and much cheaper for the patient. Suppose that the patient is a myope of −5 D; we know that if N denote the number of centrads (or prism dioptres) required, and if l denote the decentration in millimetres, $l = \frac{10\ N}{D}$.

In this case N = 2, and D = − 5

so $l = \frac{20}{-5} = -4$ mm.

The minus sign reminds one that the decentration must occur in the direction of the thin edge of the prism, so the right lens must be decentred outwards and upwards 30° along the line A C (Fig 1), and the left lens outwards and downwards 30°. If the decentration had carried a positive sign, i.e. if the lens had been convex, the decentration would have given the direction of the base of the prism, as the centre is always the thickest part of a convex lens.

All this is well known, and was practically pointed out by Mr. Charles Prentice, of New York, in 1890; but should the patient have oblique astigmatism, the matter is not so simple, for cylindrical lenses do not obey the parallelogram law.

Oblique Cylinders

A cylindrical lens of C dioptres set with its plane axis at 0° exerts that power only in the 90° plane, it exerts no power in the 0° plane and its power in an intermediate plane θ, which may be denoted by Cθ must be determined.

Now every oblique section of a cylinder is an ellipse; let ABA′

represent the elliptical contour of the oblique section of a cylindrical lens (Fig. 2) the angle of obliquity being θ or OCA.

$\frac{OA}{CA} = \sin\theta$, but OA = CB or b, and CA = a

$$\therefore \frac{b}{a} = \sin\theta, \text{ or } a = \frac{b}{\sin\theta}$$

The radius of curvature of the ellipse at B in the ACA′ plane, is

$$\rho = \frac{a^2}{b} = \frac{1}{b}\frac{b^2}{\sin^2\theta} = \frac{b}{\sin^2\theta} = \frac{r}{\sin^2\theta}$$

for b = r the radius of the cylinder.

But $C = \frac{1000}{f'} = \frac{1000\ (\mu - 1)}{-r}$ in millimetres;

$$C_\theta = \frac{1000\ (\mu - 1)}{-\rho} = \frac{1000\ (\mu - 1)}{-r} \sin^2\theta \text{ in millimetres}$$

(1) $C_\theta = C \sin^2\theta$ in dioptres.

Consequently if θ be the angle of the plane axis with the meridian considered, the power C_θ in that meridian is always $C \sin^2\theta$.

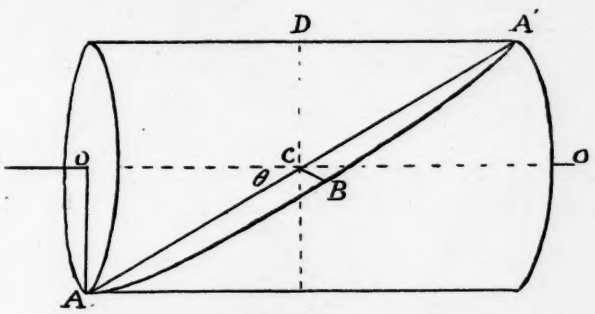

FIG. 2.

As the above reasoning was based on the fact that every oblique section of a cylindrical lens has an elliptical contour, it may be urged that I have no right to treat an ellipsoidal surface as a spherical surface. This would be a perfectly just criticism if the whole aperture of the lens were available, but the pupil of the eye only engages a very small area, of about 2 mm. radius, near the geometrical centre of the lens. As the radius of curvature of the cylindrical lens is usually more than 250 mm., the small area engaged is indistinguishable from a spherical surface. It is true that when during eccentric vision peripheral parts of ordinary spherocylinders are employed, neither the astigmatism nor the heterophoria is accurately corrected. This rarely causes much inconvenience, and if it does, the patient learns to avoid it by moving his head and not his eyes, so as always to use the central parts of his lenses.

Returning now to the application of the formula (1), if AC in Fig 1. represent the direction of the plane axis of a — 4 D cylinder, the angle OAC (θ) would be represented on the trial frame by 150°, and the angle between AC and the vertical meridian would be θ — 90. Consequently the effective power of the — 4 D cyl. ax.

would be $-4 \sin^2 \theta$ in the horizontal meridian, and $-4 \sin^2 (\theta - 90°)$ or $-4 \cos^2 \theta$ in the vertical meridian. Of course, if $\theta = 150°$ it is simple enough.

In the horizontal meridian $-4 \sin^2 150° = -4 \left(\frac{1}{2}\right)^2 = -1$ D, in the vertical meridian $-4 \cos^2 150° = -4 \left(\frac{\sqrt{3}}{2}\right)^2 = -3$D.

This can be easily verified with a lens measure, if it be placed at 30° with the plane axis of a 4 D cylinder the reading is 1, and if placed at 60° the reading is 3.

In most cases, however, it is very troublesome to find the squares of sines and cosines, but the following simple trigonometrical formulae enable us to read off their values directly from the ordinary tables.

$\sin^2\theta = \frac{1}{2}(1 - \cos 2\theta) = \frac{1}{2}$ vers 2θ

$\cos^2\theta = \frac{1}{2}(1 + \cos 2\theta)$

Suppose now that we wish to combine the effect of a 1 $\bigtriangledown$ edge up and a 1·75 $\bigtriangledown$ edge out with a spherocylinder of -5 D -4 D cyl. ax. 15°, the procedure in this troublesome case would be as follows.

In the horizontal plane the effective power would be

$-5 - 4\sin^2 15° = -5 - 2(1 - \cos 30°) = -5 - 2 \text{vers } 30° = -5{\cdot}268$ D.

In the vertical plane the power would be

$-5 - 2(1 + \cos 30°) = -5 - 2(1{\cdot}866) = -8{\cdot}732$ D.

In the vertical plane 1 $\bigtriangledown$ edge up is required, so that the appropriate vertical decentration $v = \frac{10}{-8{\cdot}732} = -1{\cdot}145$ mm.

In the horizontal plane 1·75 $\bigtriangledown$ edge out is required, so the horizontal decentration $h = \frac{17{\cdot}5}{-5{\cdot}268} = -3{\cdot}322$ mm.

An oblique decentration l mm. in length at angle α will give the prismatic effect required, where $1 = \sqrt{v^2 + h^2}$ and $\tan \alpha = \frac{v}{h}$

$1 = \sqrt{1{\cdot}311 + 11{\cdot}036} = 3{\cdot}514$ mm.

$\tan \alpha = \frac{1{\cdot}145}{3{\cdot}322} = {\cdot}3447 \quad \therefore \alpha = 19°$

The lens should therefore be decentred 3·5 mm. outwards and upwards 19° from the horizontal.

With the help of logarithms or a slide rule the above calculations can be very quickly made, as we can rarely prescribe prisms with greater accuracy than ·5 $\bigtriangledown$, and no optician can be expected to decentre a lens in tenths of millimetres, or to measure its obliquity in anything finer than degrees. This example will clearly show the method of decentring spherocylinders.

Two Oblique Cylinders

Two cylinders C and C_2 set at angles α and β are equivalent to a spherical lens of power D combined with a cylinder C_3 set at an angle γ. The methods which have been given for determining D, C and γ are usually very tedious, and some of them are inaccurate. This is a short and simple method.

It has been shown that a cylinder of power C if set with axis at α exerts in the horizontal plane an effective power

$$C\alpha = \frac{C}{2}(1-\cos 2\alpha)$$

and in the plane at 45° an effective power

$$C_{\alpha-45^\circ} = \frac{C}{2}(1-\cos 2\overline{\alpha-45^\circ}) = \frac{C}{2}(1-\sin 2\alpha)$$

Hence the effective power in the horizontal plane of C_1 at α and C_2 at β is given by

$$\text{(A)}\quad \frac{C_1}{2}(1-\cos 2\alpha)+\frac{C}{2}(1-\cos 2\beta) = \frac{C}{2}(1-\cos 2\gamma)+D$$

and the power in the plane at 45° is given by

$$\text{(B)}\quad \frac{C_1}{2}(1-\sin 2\alpha)+\frac{C_2}{2}(1-\sin 2\beta) = \frac{C}{2}(1-\sin 2\gamma)+D.$$

It is clear that whatever be the plane considered the relation

$$\text{(a)}\quad \frac{C}{2}+\frac{C_2}{2} = \frac{C_3}{2}+D, \text{ or } D = \frac{C_1+C_2-C_3}{2} \text{ holds.}$$

On subtracting (a) from (A) and (B) we obtain

(I) $C_1 \cos 2\alpha + C_2 \cos 2\beta = C_3 \cos 2\gamma$

(II) $C_1 \sin 2\alpha + C_2 \sin 2\beta = C_3 \sin 2\gamma$

The shortest method is first to find 2γ. On dividing (II) by the equals in (I) two values of 2γ between 0 and 360° are obtained, and therefore two values of γ between 0 and 180°.

$$\text{(b)}\quad \tan 2\gamma = \frac{C_1 \sin 2\alpha + C_2 \sin 2\beta}{C \cos 2\alpha + C_2 \cos 2\beta}$$

$$\text{(c)}\quad \text{Finally } C = \frac{C_1 \cos 2\alpha + C_2 \cos 2\beta}{\cos 2\gamma}$$

which gives a positive or negative value of C_3 according to the sign of $\cos 2\gamma$.

Example: Find the resultant effect of a −3D cyl. ax. 15° and a +4D cyl. ax. 60°.

Here $\beta - \alpha = 45°$, and it is very tempting to find C_3 and D first by squaring and adding I and II, but we shall then get into difficulties about the values of γ. In order to show the advantage of finding 2γ from $\tan 2\gamma$, we will begin by squaring and adding (I) and (II) in order to find C_3:

$$C_3^2 + 2\,C_1\,C_2\,(\cos 2\alpha \cos 2\beta + \sin 2\alpha \sin 2\beta) + C_2^2 = C_3^2$$

$$\text{or } C_1^2 + 2\,C_1\,C_2 \cos 2(\alpha - \beta) + C_2^2 = C_3^2$$

$$\text{here} \quad 9 - 24 \cos(-90^\circ) + 16 = C_3^2 = 25$$

$\therefore C_3 = \pm 5$, and by (a) $D = \frac{1}{2}(-3 + 4 \mp 5) = -2$ or $+3$

The solution is then -2 D sph. $+5$ D cyl. or $+3$ D sph. -5 D cyl., but if we attempt to find γ from either (I) or (II) we shall obtain two values of 2γ if C_3 is $+5$, and two other values if C_3 is -5. We must use (b) and find $\tan 2\gamma$.

$$\tan 2\gamma = \frac{-3 \sin 30^\circ + 4 \sin 120^\circ}{-3 \cos 30^\circ + 4 \cos 120^\circ} = \frac{-1{\cdot}5 + 2\sqrt{3}}{-1{\cdot}5\sqrt{3} - 2} = \tan(n\pi - 23^\circ\,8')$$

$\therefore 2\gamma = 156^\circ\,52'$ or $336^\circ\,52'$ and $\gamma = 78^\circ\,26'$ or $168^\circ\,26'$

As the denominator is negative, from (c) it is seen that $\cos 2\gamma$ must be negative if C_3 is positive and *vice versa*. The combination then is equivalent to either

-2 D sph. $+5$ D cyl. ax. $78^\circ\,26'$ or $+3$ D sph. -5 D cyl. ax. $168^\circ\,26'$

This, however, is not a mere mathematical exercise, but it explains a phenomenon that all careful retinoscopists must have observed, which has puzzled me for the last twenty years. Suppose the true correction for a patient to be $+3$ $+4$ cyl. ax. 85°, and when doing the retinoscopy the surgeon has corrected the meridian of least refraction with a convex lens and that on adding a convex lens of $+3.5$ D he has nearly corrected the refraction in the meridian about 90°. He should then substitute a $+3{\cdot}5$ cylinder for the sphere as this will give him the best objective means of determining the position of the axis. Suppose that he puts it at 90°. On rotating the mirror he will then find that the light does not move horizontally but obliquely at about 150° as indicated on the trial frame. This shows at once that the cylinder is not set correctly, and that it requires rotating clockwise. It will require a rotation of exactly 5° for the movement of the light to occur at right angles to the plane axis of the cylinder, and this is the final objective test of the correct position of the cylinder. As the obliquity of the shadow magnifies the error in position of the cylinder, this is seen to be a very exact method of determining the correct axis of the cylinder.

In the above case we may suppose the eye to be of astigmatism -4D at 85° and, the hypermetropia having been already corrected, we have only to find the resultant effect of -4 cyl. ax. 85° and $+3{\cdot}5$ cyl. ax. 90°.

$$\text{By (b) } \tan 2\gamma = \frac{-4 \sin 170^\circ + 3{\cdot}5 \sin 180^\circ}{-4 \cos 170^\circ + 3{\cdot}5 \cos 180^\circ} = \frac{-4 \sin 10^\circ}{+4 \cos 10^\circ - 3{\cdot}5}$$

$$= \frac{-{\cdot}6945928}{+{\cdot}4392312} \therefore 2\gamma = n\pi - 57^\circ\,42', \text{ nearly, } i.e., 122^\circ\,18' \text{ or } 302^\circ\,18'$$

As the astigmatism is still undercorrected, C_3 is negative, and so $\cos 2\gamma$ in (c) must be negative, *i.e.*, $\cos 2\gamma = \cos 122° 18'$ or $\gamma = 61° 9'$ but $90° - 61° = 29°$ and we must turn the cylinder 5° clockwise, or practically about $\frac{1}{6}$ of the error suggested by the obliquity of the movement of the light. It will be found in this way that when the error in the position of the axis of the cylinder is 5°, if the error in the correction of the astigmatism be 1D, whether in excess or defect, the obliquity of the movement of the light will magnify the real fault in position about four times, but if the error in the astigmatic correction be 0·5D, the magnification of the fault in position will be about six times.

ANNOTATIONS

Ship Lighting

The Illuminating Engineering Society are gradually getting a collection of valuable papers on all lighting problems written by practical experts in their own line. One of the latest contributions appears in their *Journal* for May of this year and deals with the question of ship lighting in relation to safety, comfort and efficiency. The writer was Mr. W. J. Jones and in the subsequent discussion representatives of the Navy and mercantile marine took part. The problem of safe and efficient lighting of ships is a very special one with difficulties of its own. There seems to be very little literature on the subject. The Board of Trade regulations leave considerable latitude, and there seems to be but little effort at any system of standardization of illumination or fittings. The paper dealt mainly with technical details such as the nature of the lamps and fittings and the arrangements for indicating the failure of important lamps like sidelights, but several matters such as the efficient lighting of charts, etc., also received attention. It was suggested that as charts were made and examined by daylight some system of artificial daylight coming from below might be better than the usual system. Captain Nicholson pointed out that the navigating officer in bad weather or coastal navigation avoided the chart room at night as far as possible, owing to the bright light preventing him from seeing anything for some time after coming out. He had found that by closing one eye, and keeping it closed while in the chart room, he was not affected in this way and could see quite well on coming out. Another interesting point noted by Commander Waller was that the Navy used twice as much light in the starboard light as in the port one on account of the greater absorption that took place in the green glass.

Kinema Studio Lighting

In another column is published the Interim Report of the Committee on the Causes and Prevention of Blindness regarding the alleged dangerous lights used in kinema studios. Readers will remember that a question was asked upon the subject in the House of Commons and that it was referred by the Minister of Health to the Committee in question. The Committee's report is most reassuring. It was shown by witnesses that the inflammation of the eyes was merely transitory, occurring within a few hours of leaving the studio, and speedily subsiding. No evidence was obtained that the inflammation was ever permanent or serious. As regards this country practically all complaints of which the Committee have heard date from the last three months of 1920, and coincided with the introduction and injudicious use of certain very powerful arc lamps of the search-light type, largely imported from America. The evidence went to show that injuries to the eyes have occurred in kinema studios from the use of unscreened arc lights, that no injury has occurred from the use of adequately screened arc lamps, and finally that the use of unscreened arc lights in these studios is not necessary.

The Committee thinks that the eye trouble is due to the unimpeded access of ultra-violet rays to the eyes. The Committee is definitely of the opinion that the employment of suitably enclosed and screened arc lights is not likely to be dangerous to the eyes apart from culpable temerity on the part of the artistes.

COMMITTEE ON THE CAUSES AND PREVENTION OF BLINDNESS

Interim Report regarding alleged dangerous lights in Kinema Studios.

To the Rt. Hon. Sir Alfred Mond, Bart., M.P.,
Minister of Health.

SIR,

We have the honour to present the following Interim Report:—

During the last three months of 1920, complaints were made to the Actors' Association by actors and actresses working in kinematograph studios, of injury to the eyes, caused by intense lights used for the production of films in these studios. A question on this subject was asked in the House of Commons, and the Minister of Health referred the matter to the Committee on the Causes and Prevention of Blindness for consideration and report.

We have inquired into the question, taking evidence as to

injuries to the eyes from artists and others engaged in film production, and from illuminating engineers, film producers, and photographers as to the types of lamp used in kinema studios, and the manner of their usage. The Committee also visited a large studio and witnessed the actual production of films.

Sir Anderson Critchett, Bt., honorary ophthalmic surgeon to the Actors' Association, gave evidence as to five patients, one actor and four actresses, who had recently consulted him on account of eye trouble following exposure to the intense lights used in studios. The cases reported all occurred in October and November, 1920. The symptoms described were those of conjunctival inflammation, causing pain and photophobia, and in one of the cases there was stated to be some degree of retinitis; in all, the injury was transient, and in the most severe of them recovery was complete by February, 1921.

Mr. Alfred Lugg, Secretary to the Actors' Association, gave evidence to the effect that transient attacks of pain and inflammation of the eyes have of late occurred frequently among actors and actresses engaged in film production, and that a number of artistes suffer from bloodshot eyes attributed to the strong lights used. He stated that transient eye injuries from this cause are well known among film actors in America. Other witnesses stated that the attacks of inflammation do not occur immedately, but within a few hours after leaving the studio, the sufferer awaking from sleep the same night with pain and smarting in the eye, lacrymation, photophobia, and a feeling as if the eyes were full of sand. These symptoms yield to simple remedies, and last, at most, a few days.

We regard it as established that, as a result of their occupation, injuries to the eyes of a transient, and in most cases trivial nature, have recently occurred among kinematograph artistes. We have had no evidence that serious or permanent injuries have arisen from this cause.

As regards this country, practically all complaints of which we have heard date from the last three months of 1920, and such injuries as have occurred coincide with the introduction and injudicious use of certain very powerful arc lamps of the search-light type, largely imported from America.

As to the types of lamp used in kinema studios, we have taken the evidence of Mr. Leon Gaster, Honorary Secretary of the Illuminating Engineering Society; Mr. Ruthven Murray, M.I.C.E., who has made a special study of the supply of energy to and lighting of kinema studios; Mr. Maurice Elvey, chief producer, and Mr. Paul Burger, chief photographer of Stoll Picture Productions, Limited; a deputation from the Incorporated Association of Kinematograph Manufacturers, Limited; Mr. L. V. Cargill, F.R.C.S., who has made a report to Stoll Picture Productions,

Limited, on the alleged danger from the lamps used; and Mr. Lamplough, director of research for Messrs. Chance Brothers, Limited.

The evidence of these witnesses is to the effect that—

(1) Injuries to the eyes have occurred in kinema studios from the use of unscreened* arc lights.

(2) No injuries have occurred from the use of adequately screened arc or mercurial vapour lamps.

(3) The use of unscreened arc lights in these studios is not necessary.

On this evidence we offer the following observations:

(1) and (2). Before the use of these exceptionally powerful unscreened arc lights for film production in this country, cases of injuries to the eyes from electric lights in studios were, so far as we have been able to learn, unknown; they certainly must have been very rare. Many artistes, producers, photographers and electric lighting operatives, have worked for several years in British kinema studios, without ever experiencing the least inconvenience to their eyes.

About May, 1920, new patterns of arc lamps of the searchlight type were imported from America, and have since been used in several British studios. In some instances during the latter months of 1920, the diffusing glass screens with which such lamps are ordinarily provided, were not used; such injuries as have been reported to us occurred in these circumstances.

Unscreened arc lamps are, in our opinion, liable to cause injury by reason of the unimpeded access of ultra-violet rays to the eyes. The danger is increased according to the proximity of the eyes to the lights and to the duration of the exposure.

In one studio visited by us goggles were provided for the artistes as a form of protection, but they did not appear to be generally worn, nor, indeed, did their use during the actual production of films appear to be practicable.

In certain types of arc lamp commonly used in kinema studios, the cores of the carbons emit irritating vapours composed of suspended particles and products of combustion. Danger might arise from this source, but it is unlikely to be serious unless the lamps were very close to the artistes.

It is possible that danger might arise from the artistes looking directly at the lights, even if these were properly screened, owing to the intensity of the luminous rays. Permanent damage to sight has been caused, for example, by viewing eclipses of the sun with the naked or inadequately protected eyes. There is no evidence that any such injury has been caused in kinema studios, and we are

* *Note.*—We use the term "Screen" to indicate the glass which encloses or covers the lamp and which cuts off the dangerous part of the ultra-violet radiation.

of opinion that suitably enclosed and screened arc lights are not likely to be dangerous apart from culpable temerity on the part of the artistes.

(3) The evidence of electric light experts and photographers is to the effect that not only is the use of unscreened arc lights unnecessary for the purpose of film production, but that better photographic results can be obtained when filters are used. The screens ordinarily used are of spun glass, which diminishes the glare, and cuts off the greater part of the dangerous ultra-violet rays.

The Incorporated Association of Kinematograph Manufacturers, Ltd., an association which comprises practically all the film-producing firms in this country, is so much impressed by the evidence of danger to the eyes from unscreened arc lights, that it has given its assurance to the Minister of Health that—

". . . In no case will any member of the Incorporated "Association of Kinematograph Manufacturers, Ltd., from now "onwards, and as has been the case for some weeks past, permit "any open arc lights to be used in their studios for general "illumination without glass filters, and the Association is willing to "be responsible for its members in that respect, undertaking to "notify to the Ministry any studio among its members unwilling to "abide by this condition."

In consideration of the fact that the producers and photographic experts have definitely stated in evidence that such unscreened arc lights are not necessary for film production, and that the Incorporated Association of Kinematograph Manufacturers, Ltd., have given the above quoted assurance, we are of opinion that their undertaking should be accepted, and that further action is unnecessary for the present.

At the same time we realise that the industry is in a state of development. Research is required to determine what types of lamp are best adapted to the purposes of film production. Since new developments may mean new dangers to the artistes, we strongly recommend that this aspect should be made the subject of special investigation, and we are glad to learn from Mr. Leon Gaster that the Illuminating Engineering Society contemplate the formation of a Joint Committee, to include representatives of the kinema industry, lighting experts, ophthalmologists and others interested, for the purpose of studying the whole question.

(Signed on behalf of the Committee),

GEO. H. ROBERTS, *Chairman.*

REGINALD FARRAR,
P. N. R. BUTCHER, } *Secretaries.*

Dated *27th May*, 1921.

COMMITTEE ON GLASS-WORKERS' CATARACT

The following is taken from the Report of the Chief Inspector of Factories for 1921.

Constitution.—The Glass-workers' Cataract Committee of the Royal Society was appointed on June 18, 1908. The members were Sir William Abney, Sir Clifford Allbutt, Dr. H. K. Anderson, Sir John Rose Bradford, Dr. G. J. Burch, Sir William Crookes, Mr. Marcus Gunn, Mr. E. Nettleship, Mr. J. Herbert Parsons, and Dr. A. D. Waller. Since its appointment the Committee has lost by death Dr. Burch, Sir William Crookes, Mr. Marcus Gunn and Mr. Nettleship.

Reference.—The Committee was appointed to investigate "the physical and physiological problems" involved in the causation of Glass-Workers' Cataract, and to advise as to the measures which should be adopted for the prevention of the disease. (*See* letter from Home Office, April 7, 1908.)

Preliminary Investigation.—In August and September, 1908, a visiting Sub-Committee, consisting of Messrs. Anderson, Burch, Gunn and Parsons, visited glass works at Sunderland, Gateshead, and St. Helen's. They acquainted themselves with the incidence and clinical manifestations of the disease, and with the conditions in which the men carry out their work. In March, 1909, Sir William Crookes visited the Glass Bottle Works of Messrs. Nuttall & Co., at St. Helen's, and made accurate investigations of the temperature of the molten glass in the tanks and of the radiations emitted. A series of spectro-photographs was taken.

A suitable spectroscope enables the observer to analyse the radiations emitted from such a source of energy as molten glass. By its means the luminous rays are spread out into a spectrum, which is red at one end and violet at the other. The wave-lengths of the radiations are greatest at the red end and diminish continuously to the violet end. Beyond each end of the luminous spectrum are radiations which are invisible to the human eye. Those of shorter wave-length beyond the violet end—the ultra-violet rays—are extremely active in producing chemical change, *e.g.*, on a photographic plate, and are, hence, known as the chemical or actinic rays. The radiations of longer wave-length beyond the red end are specially active in raising the temperature of bodies on which they fall and by which they are absorbed. They are, therefore, known as the heat rays. A source such as molten glass might also conceivably emit X-rays.

The preliminary investigation showed:—

(1) That no X-rays were emitted.

(2) That luminous and ultra-violet rays were emitted in considerable amount.

(3) That the preponderant emission was of heat rays.

It is an established principle that radiations do not produce any change in the physical or chemical constitution of any substance upon which they fall unless they are absorbed by the substance. Hence the next step in the investigation was to discover which, if any, of the radiations were absorbed by the media of the eye.

Luminous Rays.—The luminous rays are not absorbed by the transparent media of the eye to any appreciable extent, and consequently cannot be the cause of cataractous changes in the crystalline lens.

Ultra-violet Rays.—It is known that ultra-violet rays are absorbed by various structures of the body. They are the cause of inflammation of the eye known as Snow Blindness and Electric Light Ophthalmia. Experiments were therefore carried out by Messrs. E. E. Henderson and Parsons, and were continued and completed by Mr. E. K. Martin to determine the effects of exposure of rabbits' eyes to light rich in ultra-violet rays and the absorption by the media of the eye of these rays.

The experiments showed :—

(1) That, although the cornea absorbs some of the shorter ultra-violet rays falling upon the eye, there are others of longer wave-length which pass through the cornea unimpeded, but are absorbed by the crystalline lens. It is therefore possible that ultra-violet rays may be the cause of changes in the lens substance, and that these may be of such a nature as to produce opacities, *i.e.*, cataract.

(2) That definite changes in the lens are, in fact, caused by repeated and prolonged exposure to ultra-violet radiation. They occur chiefly in the anterior portion of the lens, but no changes of the type of Glass-Workers' Cataract have hitherto been obtained by experimental methods.

Heat Rays.—The absorption of radiant heat by the media of the eye was investigated for the Committee by Messrs. H. Hartridge and A. V. Hill. The research involved the design and construction of an infra-red spectrometer, and led to results of great value. Of these the most important from the point of view of the origin of Glass-Workers' Cataract are :—

(1) That a considerable percentage of the heat energy incident on the cornea is absorbed by the crystalline lens. It is therefore possible that cataract may be induced in this manner. In this connection it is worthy of note that sporadic cases of cataract, similar to those found in Glass-Workers, have been observed in Iron-Workers. The fewness of the recorded cases may be due to the shorter duration of direct exposure of the eyes to the radiation.

(2) That the iris absorbs practically all the heat radiation

which falls upon it. The importance of this observation will now be discussed.

Indirect Action.—The crystalline lens receives its nourishment from fluid which is derived from the vascular coat of the eye, especially the ciliary body, which is continuous with the iris. If, owing to disease or disturbance of function of the ciliary body this fluid is altered in character, the lens is likely to suffer. The deleterious effect usually manifests itself in the form of cataract commencing in the posterior layers of the lens and therefore somewhat resembling Glass-Workers' Cataract. Since Glass-Workers' Cataract does not usually arise until after many years' exposure to the conditions of work, it has seemed probable to some members of the Committee that it is not due to direct action of the radiation upon the lens itself, but rather to indirect action affecting the nutrition of the lens through the ciliary body. Certain preliminary experiments carried out by Messrs. E. E. Henderson and Parsons, and by Mr. E. K. Martin afford some support to this hypothesis. The observation of Messrs. Hartridge and Hill on the absorption of radiant heat by the iris points strongly in the same direction.

Prevention. — Although the exact nature of the radiation responsible for the development of Glass-Workers' Cataract, and the exact rationale of its action were as yet unknown, Sir William Crookes early instituted experiments on behalf of the Committee with a view to discovering some means of cutting off as much as possible of the ultra-violet and infra-red radiation from the eye. He prepared a large number of glasses, containing salts of various metals, and succeeded in discovering several which excellently fulfilled the requirements. Some of those which absorb ultra-violet radiation have since been placed upon the market and are known as "Crookes's glass." It is probable that if the workers wore spectacles made of the appropriate glass the disease would be abolished. It is to be remembered, however, that it is almost impossible to get workmen to wear protective glasses. The attempt has indeed been made with unsatisfactory results.

Summary.—The investigations already carried out show:—

(1) That the luminous rays are not the cause of the disease.

(2) That ultra-violet radiation is not the cause in so far as any direct action upon the lens is concerned.

(3) That the evidence is strongly in favour of the view that heat is the active agent.

(4) That it is uncertain whether the heat radiation acts directly on the substance of the lens, or indirectly by disturbing the nutrition of the lens.

(5) That possibly ultra-violet radiation may play some part in the causation by indirect action on the nutrition of the lens.

Future Work.—It will be seen that very satisfactory results, both as regards cause and prevention, have already been obtained. The research cannot, however, be regarded as completed. Further investigation of the effect of heat radiation upon the eye is needed, especially with the object of producing cataract experimentally by this means. For this purpose further research on the chemistry of the crystalline lens is required. It is also most desirable that the exact method of action of the radiation, whether direct or indirect, as explained above, should be settled.

Further, the difficulties of manufacturing glasses which absorb the heat radiation have not yet been completely overcome, and it is very important that this work should be carried out.

COUNCIL OF BRITISH OPHTHALMOLOGISTS

A Report on some Public Authorities who are in the habit of referring Ophthalmic Cases to Hospitals for Examination, Treatment and (or) Report.

The following Report was passed at the meeting of the Council of British Ophthalmologists on July 5 last:—

The Committee has enquired into the medical service of the following Public Authorities:—

Post Office. Army Pensions. Old Age Pensions for the Blind.

Post Office.—The Committee has ascertained that the Postal Authorities provide medical treatment for those of their employés whose pay is under a certain wage limit, with the object of ensuring their efficiency for the performance of their duties, and that they appoint medical officers for this purpose. The Committee notes that no ophthalmic surgeons or other specialists are officially appointed.

The cases requiring advice, treatment and report (by ophthalmic surgeons) are so numerous that the efficiency of the service cannot be maintained without such assistance; the result is that the medical service of the post office is being supplemented by the services of the honorary staffs of the special ophthalmic hospitals and of the eye departments of the general hospitals.

The Committee recommends that the Council should report to the Postal Authorities that their medical service cannot be adequate unless it includes the service of ophthalmic surgeons whose duty it should be to examine the eyes of recruits, to treat employés, and when necessary, to furnish reports upon which official action can legitimately be taken.

Army Pensions. Old Age Pensions for the Blind.—The Committee finds that the authorities have made arrangements for the examination of the eyes of army pensioners, and of blind claimants for the Old Age Pensions. In consequence, it is now outside the duties of the medical officers of any hospital to make examination or report for either of these purposes.

ABSTRACTS

I—TUMOUR OF THE FRONTAL LOBE OF THE BRAIN WITH OCULAR SYMPTOMS

Knapp, Arnold (New York).—Report of a tumour of the frontal lobe of the brain with ocular symptoms. Autopsy. *Trans. Amer. Ophthal. Soc.*, Vol. XV. (1917), p. 85.

Knapp's patient, a man of 36 years, suffered from atrophy of the discs, a central scotoma in each eye, and defective sight (R.V. 20/50 ; L.V. 2/200). Wassermann reaction positive. The condition failed to improve under treatment, and the man became apathetic and mentally slow, and numbness of the right side of the face developed. Examination by X-rays, which showed excavation and bone rarefaction in the anterior and the middle cranial fossa, suggested pressure by an unusual mass in the sellar region. The patient succumbed to haemorrhage after an exploratory operation on the skull.

At the autopsy a firm tumour, measuring 2 by 2½ inches, was found in the right frontal lobe, springing from the dura on the convexity and from the adjoining part of the falx. The right frontal lobe was greatly enlarged at the expense of the left, so that the median line ran obliquely in the left half of the skull. The cortex of the right lobe was much reduced in size. The bone covering the ethmoidal and sphenoidal cells was very thin. The optic nerves were flattened. Posterior to the chiasma there was a rounded, bulging mass, a distended tuber cinereum, which had crowded the optic tracts apart and had hidden the mammillary bodies. The walls of this distended area were so thin as to be translucent. The dilatation of the third ventricle was limited to its lowest part, forming a sacculated diverticulum. The hypophysis was enlarged and displaced backwards. The dural covering of the pituitary fossa was intact, and the infundibular opening was not enlarged. The tumour was an endothelioma.

Briefly, the brain showed a frontal tumour in an enormously enlarged right lobe which had produced a sacculated distension of the third ventricle and pressure atrophy of the underlying bone in

the anterior and middle cranial fossae. The bilateral central scotoma and the excavation of structures anterior to the anterior clinoid processes, as shown by X-rays, suggested a definite localization of the tumour at the base of the frontal lobe, but the autopsy showed that the tumour was situated at the convexity of the right frontal lobe, next to the falx.

S. S.

II.—AETIOLOGY OF CHRONIC MEIBOMITIS.

Gifford, R. Sanford (Omaha, Nebraska).—The Etiology of chronic Meibomitis. *Amer. Jl. of Ophthal.*, August, 1921, pp. 566-570.

Gifford investigated the bacteriology of the Meibomian secretion in 65 cases. His method of obtaining the secretion of the glands without contamination from the lids or lashes, was to wipe the margins of the lids with a slightly moist sterile sponge, then to squeeze both lids together and rub the loop along the mouths of the glands. Moist Loeffler's blood-serum, or cooked-meat broth, gave the best results for culture of the pneumococcus, streptococcus, Morax-Axenfeld bacillus, and B. xerosis.

He tabulates his results as follows: Table I. Simple Meibomitis; Table II. Meibomitis with Hypertrophy; Table III, Meibomitis with Chalazia; Table IV. Normal Lids—Medical Students; and Table V. Normal Lids—Old Men at County Hospital. The findings for smear and culture are given, the former being considered the more valuable evidence when organisms are present.

The first two tables comprise the results of twenty cases.

The B. xerosis was found in rather less than 50 per cent. of these cases, staphylococcus being present in almost every case. In the five cases given under Table III, B. xerosis was found twice, and staphylococcus four times. The pneumococcus was very rarely met with in any of the 65 cases.

In the normal lids of the younger age group (Table IV) B. xerosis was found three times, and staphylococcus fifteen times; in the older men (Table V) B. xerosis occurred in fourteen cases, and staphylococcus in seventeen.

The term B. xerosis was employed to include various strains of apparently cognate organisms. Gifford describes the organism as "pyophilic" to distinguish it from pyogenic or pus-forming organisms. He finds it in large numbers in the smears of old persons—whether suffering from chronic Meibomitis or not—than in those of young persons. The senile changes which take place in the lids (as the result of increased connective-tissue formation, presbyopic spasm, etc.), favour the growth of this organism, thus

giving rise to hypersecretion and Meibomitis. When the ducts of the glands become occluded, chalazia develop. He holds that in younger persons staphylococci produce a sharper reaction, which leads to occlusion of the glands and consequently to chalazium formation; whereas in the old the B. xerosis prevalent in the glands, produces a sluggish reaction which manifests itself as chronic Meibomitis.

A short review is given of the literature of the bacteriology of Meibomitis. The author refers to a previous communication of his own on the subject, but omits to give the reference.*

J. HAMILTON MCILROY.

III—THE TARSUS MADE PLIABLE AS A CURE FOR *GLAUCOMA*

Dimitry, Theodore, J. (New Orleans, La.).—The tarsus made pliable as a cure for trachoma. *Amer. Jl. of Ophthal.*, Feb., 1921, p. 107.

Dimitry describes a simple procedure which he has devised for the expulsion of the contents of the follicles in trachoma, claiming that his method is unattended by the disadvantages of the ordinary operative methods in giving rise to no increase of scar-tissue; and in addition is valuable in that the manipulation involved softens the infiltrated tarsus, and stimulates healthy cell reaction.

The technique is as follows: a piece of stout copper wire eight inches in length, bent slightly at about two inches from one end, is wrapped in a thin covering of cotton wool at the bent portion. The eye is carefully prepared for surgical operation (the author lays stress upon this), and the wool-wrapped probe, dipped in sterile water, is taken in one hand and inserted under the everted lid, the latter being supported by the thumb of the other hand. The probe is rotated upwards over the lid, steady pressure being kept up against the thumb opposed behind the lid. The tarsus is manipulated and softened by this combined action, and ischaemia alternates with hyperaemia; at the same time the contents of the follicles become expelled. When treatment is given only once, and is of necessity more drastic, general anaesthesia is required; but good results are obtained from repeated applications of a more gentle nature, local anaesthesia being sufficient. Several text illustrations are given.

J. HAMILTON MCILROY.

*The paper referred to is probably the following:—"Fusiform Bacilli on Conjunctiva and in Meibomian Glands." S. R. GIFFORD. *Arch. of Ophth.* Vol. XLIX, pp. 477-484, 1920.

IV.—MISCELLANEOUS

(1) **Black, Nelson M. (Milwaukee).—Face powder conjunctivitis.** *Ann. of Ophth.*, July, 1915.

(1) **Black** had for several years met with cases in which female patients presented the signs of a troublesome and intractable conjunctivitis, which he was eventually able to trace to the use of a face powder containing rice powder; the suggestion appears to be that the cells from the hard exterior of the rice grains were to blame.

R. H. ELLIOT.

(2) **Cozzoli, G.—Traumatic thrombosis of the central vein of the retina. (Trombosi traumatica della vena centrale della retina)** *Archiv. di Ottalm.*, July, 1916.

(2) **Cozzoli** records a case of partial thrombosis of the central vein of the retina in a man of 26 years, which came on immediately after a blow on the head in the left parietal region. He noticed that the vision of the left eye was affected on the following day. Cozzoli found that the left pupil did not react directly to light nor transmit a consensual reflex to the other eye, but itself reacted consensually. Ophthalmoscopically there were numerous haemorrhages, principally in the neighbourhood of the maxillo-nasal branch of the central vein, and the arteries were much reduced in size. Vision was reduced to 1/10th. The second pulmonary heart sound was accentuated, the superficial arteries were sclerotic, and the urine contained a trace of albumen. Treatment had no effect, and the vision sank to 1/20th, and that only in the superior-external quadrant of the field. There was no history of venereal disease, and the Wassermann reaction was negative. A coloured plate accompanies the paper.

E. E. H.

(3) **Suker, George Francis (Chicago). – Optic neuritis (unilateral) resulting from a tonsillar infection.** *Ophthal. Record*, June, 1917.

(3) **Suker** reports a case of left-sided optic neuritis with blurring of the macular area, but no retinal haemorrhages, ascribed to infection from septic tonsils. Vision was 20/60 (R.V. = 20/16), the field was constricted for form and colours, and the blind spot was a trifle enlarged downwards. Within 36 hours after enucleation of the tonsils vision rose to 20/40, and within 72 hours to 20/20.

J. JAMESON EVANS.

(4) **Gifford, H. (Omaha).—The habitual use of spectacles. An insurance against traumatism rather than a risk.** *Ophthal. Record*, October, 1917.

(4) During thirty-three years of eye work **Gifford** has met with

five cases in which an eye has been injured by a broken spectacle lens. In none of these was the eye lost, and in at least two of them it is probable, the author thinks, that if glasses had not been worn a worse injury would have occurred. To this Gifford opposes the fact that during the same length of time he has seen some 2,300 cases of serious traumatic injury to the eye, at least 90 per cent. of which would probably not have occurred if glasses had been habitually worn. "The protection which spectacles afford is so much greater than the risk which they involve, that every person with only one good eye should habitually wear them."

S. S.

(5) **Hirsch, G. (Halberstadt).—Temporary formation of clefts in both lenses.** *Klin. Monatsbl. f. Augenheilk.*, September-October, 1917.

(5) **Hirsch's** case was that of a woman aged 43 who consulted him on account of sudden diminution of vision which came on after a long walk of about 25 km. in one day with very little nourishment. On examination V. in right eye with $-1{\cdot}5$ was 5/7, and in left eye with -2 was 5/10. Both lenses showed numerous fine radial refractive sectors. The correcting glasses were ordered and the case was diagnosed as early senile cataract. The patient returned within the week and said that four days later the sight suddenly improved and she could see better without the glasses. V. was now 5/5 in both eyes and the lenses were perfectly clear. There was no history of the use of any drug or exposure to any poison, such as naphthol, and the urine was normal.

E. E. H.

(6) **Leavitt, M. J. (Brooklyn).—A case of recurrent paralysis of the right abducens lasting twenty-one years.** *Ophthal. Record*, September, 1917.

(6) **Leavitt** describes a rare case of recurrent paralysis of the right sixth nerve, which first appeared after an attack of measles in a girl who was then one and a half year of age. At first the intervals between the attacks lasted six to thirteen months, but for the last four and a half years the normal intervals became shortened to from two days to four months, and the period of paralysis became extended from five or six weeks to seven weeks.

Before the eye became paralysed she had severe headache, chills, and fever, sometimes nausea and vomiting for two days, and she was obliged to stay in bed and was unable to eat anything. When the eye was getting better she experienced a sort of pressing sensation in the eye and head and a feeling as if the eye was turning back to its normal position.

The last attack lasted two months before the paralysis began to

disappear, and it was another month before the movement was completely restored.

After having twenty-five to thirty attacks the muscle, when not paralysed, seemed as good as ever.

The aetiology by analogy with oculo-motor paralysis of the same type is probably inflammatory or oedematous changes involving the nerve root.

J. JAMESON EVANS.

(7) **Doesschate, Ten and de Kleijn.—A case of permanent palsy of the superior oblique after Killian's operation. (Een geval van blijvende verlamming van den musculus obliquus en op, na een operatie volgens Killian.)** *Nederlandsch Tijdschrift voor Geneeskunde* 1916, Part i, p. 1957.

(7) In Killian's operation on the frontal sinus the trochlea was originally respected carefully from fear of paralysis of the oblique muscle. Later experience showed that even if the trochlea was removed, the resulting diplopia soon disappeared. Hajeh even claims that this is always so. **Doesschate** and **de Kleijn,** however, observed a case in which, after removal of the trochlea, diplopia was so disturbing that the eye on the operated side had to be constantly occluded by a ground glass, even a year after the operation.

G. F. ROCHAT.

(8) **Walker, Clifford B., and Cushing, Harvey (Boston).—Studies of optic nerve atrophy in association with chiasmal lesions.** *Arch. of Ophthal.*, Vol. XLV, No. 5.

(8) **Walker** and **Cushing** give the following as the conclusions, drawn from their studies of optic nerve atrophy in association with chiasmal lesions:

1. Despite the so-called atrophic pallor of the disc in patients having visual field defects resulting from lesions in the chiasmal regions, the histological examination of the nerve fails to show the expected degree of fibre degeneration, unless the process has been of long duration,

2. The atrophy in the tracts considerably antedates that in the nerves, where the fibres may be preserved by their retinal ganglion cells for several years after complete functional blindness has occurred.

3. Their cases serve to illustrate the fact that in the presence of chiasmal pressure of known long duration associated with sharply cut hemianopsia, even when to the ophthalmoscope the nerve shows the pallor of presumed atrophy, there may be no corresponding sharp delimitation of the areas of atrophy in the cross-sections of the nerve.

4. This would at first sight seem to be an inconsistency, but more accurate perimetric findings with graded discs show that, after

all, the boundaries of the seeing areas are less sharply cut than had been previously supposed, and perhaps really correspond with the diffuse picture of the nerves.

R. H. ELLIOT.

(9) **Lemierre, A.—Amaurosis followed by a transitory hemianopia in the course of an acute nephritis; part played by cerebral oedema. (Amaurose suivie d'hemianopsie transitoire au cours d'une néphrite aiguë; rôle de l'oedème cérébrale.)** *Gazette des Hôpitaux*, June 26, 1920.

(9) **Lemierre's** case was that of a man aged 29 in whom an angina was followed by an acute nephritis marked by oedema, especially about the face, extreme scantiness of urine, vomiting, eclampsia, torpor, and by an absolute amaurosis lasting twenty-four hours, followed by a transitory right homonymous hemianopia. On the fourth day the symptoms vanished with the installation of a copious polyuria. The blindness in this case was obviously cortical in type, as shown by the integrity of the ocular fundus and the preservation of the pupillary reflex. The transformation of the complete amaurosis into a hemianopia also supports this view. Although there was a marked increase of urea in the blood, which disappeared on recovery, Lemierre does not consider that this had anything to do with the blindness. Azotaemia is the active agent in the production of retinitis (Widal, Morax, Weill, and de Rochon-Duvigneaud), but this was absent in this case. He attributes the condition to chloride retention, and refers to a case published by himself in collaboration with Widal, in which oedema was produced by sodium chloride in a case of kidney disease in which that organ was impermeable to chlorides (*Bull. et mém. de la Soc. méd. des hôpit.*, 1903, p. 678). On this hypothesis the visual troubles would be due to cerebral oedema with hypertension of cerebro-spinal fluid. The prognosis of such cases, in spite of the severity of the symptoms, is not bad, provided the polyuria comes to the rescue in time, and that a rapid increase of the azotaemia does not lead to retinal changes. Treatment is of considerable value. Bleeding to the extent of 600 ccm., and wet cupping in the lumbar region with drastic purgation are the measures recommended by the author.

E. E. H.

(10) **Babonneix, M. L.—Specificity or non-specificity of the Argyll Robertson sign. (Spécificité ou non-spécificité du signe d'Argyll Robertson.)** *Gazette des Hôpitaux*, March 26, 1921.

(10) **Babonneix** discusses in this paper the question of how far the Argyll Robertson pupil may be taken as conclusive evidence of the existence of syphilis. He gives no new facts, but merely discusses the conclusions of other observers, as well as some of his

own previously published cases. After a careful analysis of all apparent exceptions, he expresses the opinion, "that there exist in the literature some cases of the Argyll Robertson sign which seem independent of all syphilis, latent or patent. These cases are, however, so exceptional that, in practice, the recognition of this symptom signifies nerve syphilis, and should in the immense majority of cases, direct the treatment."

E. E. H.

BOOK NOTICES

Transactions of the American Ophthalmological Society. Fifty-sixth Annual Meeting, Hot Springs, V.A., 1920. Volume XVIII. Philadelphia. 1920.

This well-illustrated volume of 450 pages contains much interesting matter. From it we learn for the first time of the deaths of Samuel Doty Riseley, of Philadelphia, and of Robert Lee Randolph, of Baltimore. The Minutes of Proceedings include reports on standardisation of the illumination of test cards and perimeters, and of an International Congress of Ophthalmology. It was resolved that the name of any member absent without valid excuse for three consecutive years, or who shall have failed to contribute to the scientific proceedings of the Society by proffer of a paper or by participation in its discussions shall be expunged from its list of members. Certain exceptions are made; these include honorary members or members of twenty years' standing, or those then serving in the army or navy. A further exception is made in the case of any member living more than one thousand miles from the place of meeting.

Those scientific communications contained in the *Transactions* likely to interest our readers will be published in abstract form at a later date in the columns of this Journal.

S. S.

Ophthalmological Society of Egypt. *Bulletin* of 1920. Cairo. Printing Office of the French Institute of Oriental Archaeology, 1920.

This slim volume of 77 pages represents the Proceedings of the Annual Meeting of the Society, held on March 5, 1920, in the Pathological Museum of Kasr el Ainy Medical School, when sixty members were present. The volume contains sixteen communications, of which four have been already published in *Transactions*

of the Ophthalmological Society of the United Kingdom, Vol. XL. It is an excellent thing to include a list of abbreviations to be used by members in their communications to the Society, and such is given. It would have been more dignified if some reference had been made to the fact that they were transferred from one of the earlier volumes of the *Transactions of the Ophthalmological Society* (Vol. IV). *The Bulletin of the Ophthalmological Society of Egypt* was once notorious for the number of misprints it contained, it now stands out as one of the best edited.

S. S.

Glaucome et Glaucomateux. By V. MORAX, Ophtalmologiste de la Lariboisière. Paris: Librairie Octave Doin, Gaston Doin, Editeur, 8 Place de l'Odéon. 1921.

This book is the result of the observations of a man of long experience, wide outlook, independent judgment, and remarkable clinical acuity. As such, it is a very valuable addition to the literature of the subject.

The first chapter deals with etymology and history. The study of glaucoma is that of the lesions dependent on high tension, and of the consequences that arise therefrom. The two basic problems lie in the recognition and in the relief of high tension. A plea is entered for the more generous recognition of Pierre Demours and other French writers to whom Morax holds too little credit has been given.

Chaper II deals with ocular tension and with the methods of testing it. Digital examination is a rough and ready method with a limited clinical usefulness, and is quite unsuited for the detection of the feeble and early rises of tension, whose recognition is so very important. Manometric tonometry is discussed, and a warm tribute is paid to the work of Schiötz, of whose instrument it is said that its "use has spread to such a point as to make the tonometer as indispensable as the ophthalmoscope or the trial case." The standardization of tonometers appears to Morax to be an important work, which still remains to be carried out. He holds that the elasticity or rigidity of the cornea is a negligible factor, the real resistance of the tunic of the eye to depression being dependent on the pressure of the intraocular fluids. The chapter closes with an earnest warning against the failure to make full use of an instrument which enables us to diagnose hypertension at an early stage, and so to add greatly to the efficiency with which we treat our patients.

Visual troubles.—(1) Modification of distant vision. (2) Troubles with near vision. (3) Subjective visual troubles. (4) Coloured rings round lights. Morax discusses each in turn, and his remarks on the true and false haloes of glaucoma are of especial interest.

Morax discusses the nature of the anterior ciliary vessels which dip through the sclera, and which are so constantly found dilated in subacute glaucoma.

Shallowing of the anterior chamber is an important sign in acute and subacute glaucoma, but outside this, has no diagnostic significance, save in the cases of secondary glaucoma in which the iris is involved.

Dilatation of the pupil, especially when unilateral, is a sign whose significance, especially with regard to syphilis and glaucoma, should never be lost on the practitioner. There are certain possibilities of error of which we must beware. Morax discusses these at length.

Morax mentions the views of those who would ascribe the symptoms of glaucoma to a lesion of the ophthalmic ganglion, but the reviewer is glad to notice that he lends neither support nor approval to such a fantastic idea.

Ophthalmoscopic examination.—Morax enters an earnest word of warning against the use of atropin in any adult or old eye without a previous estimation of the tension of the globe. He has seen the reputations of some of his young colleagues gravely compromised by disregard of this rule; nor is such an experience confined to the other side of the Channel. It is curious that, though many medical men seem lacking in knowledge of this danger, the glaucomatous public know of it well, and do not hesitate to act upon their knowledge when a mistake is made. Morax does not believe mydriasis justifiable even when lens opacities are present, and thinks that the diagnosis should be made from the remaining features of the case. In the reviewer's experience, cocain, and better still euphthalmin, will produce sufficient mydriasis for all practical purposes in any doubtful case, and their action can be rapidly and safely neutralised by eserin.

Arterial and retinal venous pulsations are next discussed with special reference to Bailliart's and Magitot's work.

Cupping of the optic disc.—The depth of the cup varies from 0.3 to 1.6 mm. There are some admirable illustrations of glaucoma cups. Although the point is not alluded to in the text, every one of these shows the pushing over of the vessels to the nasal side, which the reviewer regards as characteristic of advanced glaucoma. Morax feels strongly that too much weight should not be attached to an ophthalmoscopic examination alone in cases of suspected glaucoma. After discussing Schnabel's views, he states his belief that lacunar formation is a process of disintegration occurring in nervous tissue, which has been deprived of its proper blood supply; the reviewer notes with pleasure his conclusion that we cannot admit that in this lacunar degeneration we have the initial lesion of glaucoma. Such a view has always seemed to be untenable and inconsistent with a broad view of the known facts of the disease.

The retinal sensibility.—This subject is discussed with especial reference to the great diversity of changes met with not only in different cases, but also in the two eyes of a single case.

Chapter VI deals with acute glaucoma. He excludes recognizable cases of secondary glaucoma, but points out that the distinction between the primary and secondary conditions is convenient rather than scientific. Equally artificial are the distinctions between acute, subacute and chronic congestive glaucoma. When one eye has been attacked by primary glaucoma, the other is almost sure to follow suit sooner or later. A case of glaucoma abandoned to itself, and sometimes even under the best therapeutic régime, will go steadily downhill. Attacks of hypertension, once they make their appearance, have a strong tendency to recur, and sooner or later, the rise in pressure becomes permanent. We have to do, not with an affection which shows itself in episodes, but with one which moves steadily towards blindness, and that of both eyes. Morax publishes some very interesting statistics of his cases of acute glaucoma. Two factors strike him in connection with acute glaucoma (1) the frequency of comparatively high grades of manifest hyperopia (from 3 to 6 D. or more) and (2) The influence of heredity.

The operation of iridectomy will in a certain number of cases restore the eye to apparent normality, but this is far from being the rule. Much depends on the care exercised by the patients to avoid conditions which may excite the attack of hypertension, and on the systematic use of miotics. In those cases, in which the discontinuance of artificial miosis leads to signs of recurrent tension, we may anticipate that, sooner or later, drug treatment will fail us. It is erroneous to suppose that this is due to the drug having lost its effect by reason of its long continuance, for it contracts the pupil, just as it did before, but that does not suffice to lower the tension to a normal level.

After operation, and in the absence of all injury to the lens, opacities may develop in that structure. Their causation is still obscure, but the possibility that we have in some cases to do with an accidental coincidence of the two conditions must be borne in mind.

Chapter XI and XII deal with secondary glaucoma. It is not always easy to assign a case to one of the two categories, primary or secondary. In the treatment of certain diseases, it is important (1) to remember the possibility of the occurrence of this complication, (2) not to miss it when it commences, (3) not to favour it by incorrect treatment, and (4) always to anticipate its onset by the use of suitable therapeutic measures.

Secondary glaucoma may result from lesions of the anterior segment of the globe, or from those of the posterior segment. In the latter case, the condition is far more serious than in the former.

Both are discussed at some length and to the great profit of the reader.

Chapter XIII deals with the diagnosis and prognosis of glaucoma. The diagnosis of glaucoma may sometimes be a very difficult matter, especially if the surgeon is not content with diagnosing an increase of tension and seeks to find out the ultimate cause of the trouble. Methodical, systematic and thorough examination of each case is called for. Morax insists on the important fact that many patients in the intervals between their glaucomatous attacks, present a normal or even a subnormal tension, whilst others show a slight hypertension. He believes that a preventive iridectomy will often enable a patient to escape from an acute attack of glaucoma, which would otherwise sooner or later supervene.

Chapter XIV deals with the treatment of glaucoma. This chapter contains a mass of most interesting and practical information which deserves not merely to be read, but to be carefully abstracted and committed to memory.

For acute glaucoma, and for the cases of secondary glaucoma, in which miotics are contra-indicated, Morax operates at once. To every other case he gives a trial with medical treatment, and takes account of the results of that treatment, and of whether reliance can be placed on the patient to carry it out. Patients who are going to take long journeys should be operated on without hesitation.

When, in spite of every care, the ocular tension remains up; we must resort to surgical means.

Operative interference. — Morax considers iridectomy the operation of choice in acute glaucoma, whilst in the other forms sclerecto-iridectomy alone yields lasting results. In operating for acute glaucoma it is sometimes necessary to use a general anaesthetic, but in a great number of cases local anaesthesia will suffice; novocain-adrenalin is injected for the purpose under the conjunctiva and around and behind the eye. The iridectomy must be large and peripheral.

Morax rightly gives to Lagrange the credit for having given a practical form to the basic idea of sclerectomy, but he would modify the technique of that worker by employing the conjunctival flap devised by Elliot. After trying many methods, Morax finds that "it is to the technique of Elliot and to that of Holth that it is most usually convenient to resort, always provided that the special instruments required can be obtained sharp." He gives in some detail his view on the technique to be employed in performing the operations of the three workers above named. Some of his drawings for the illustrations of these procedures are excellent. Chapter XV deals with the therapeutic treatment peculiar to certain forms of glaucoma, such as buphthalmos, secondary and traumatic glaucoma,

absolute glaucoma, etc., whilst Chapter XVI reviews the aetiology of the disease, and brings to a close a book which the reviewer feels that he has dealt with most inadequately, mainly owing to considerations of space. He would advise anyone whose interest has been aroused to obtain Dr. Morax's book, and to study it long and carefully.

R. H. ELLIOT.

NOTES

McGill University

MR. J. B. LAWFORD has been offered the honorary LL.D. of McGill University, and is going to Canada this autumn to receive it. We may say that he is an alumnus of that University.

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"Yacht Cruising"

THE publication of the second edition of "Yacht Cruising," by Claud Worth, should not pass unnoticed in these columns. It affords one more illustration of the versatility of some eye-surgeons. It is an expert treatise on cruising from experience gained during the brief holidays of a busy professional career.

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The American Academy of Ophthalmology and Oto-Laryngology

THE Academy will hold its twenty-sixth annual meeting on October 17, 18, and 19 next, in Philadelphia. Professor J. van der Hoeve, of Leyden, Holland, who was so welcome at the Oxford Congress last year, has accepted an invitation to be the guest of honour of the Academy.

* * *

Appointments

MR. H. C. MOONEY has been appointed Surgeon-Oculist to the Household of His Excellency the Lord Lieutenant of Ireland.

DR. J. HAMILTON MCILROY has been appointed Lecturer on Diseases of the Eye at the Lady Hardinge College, Delhi.